[Livermore and Pleasanton, San Francisco]

Livermore-Pleasanton BART Extension Study

Final Alternatives

LIVERMORE-PLEASANTON BART EXTENSION STUDY

FINAL ALTERNATIVES

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PLANNING PROCESS

This report, the fifth in a series of seven to be produced by the Livermore-Pleasanton BART Extension Study, presents the findings of detailed studies of six alternate BART extensions in the Dublin Canyon and the San Ramon Valley corridors. It is intended to be used as the basis for public hearings to be held by the Livermore-Pleasanton BART Extension Board to learn the views of affected citizens and public officials on a BART extension and on specific routes and station sites. After evaluating comments made at the hearings, the consultants will prepare a brief memorandum recommending a single route, vertical alignment and station location plan for further study. The Board then will select the system on which all remaining studies will focus. The final product of the study will be a conceptual engineering design, station site plans and support facilities plans, a refined impact analysis, and a financial and implementation plan.

In the Preliminary Alternatives report (March, 1973) initial evaluations were presented for 49 potential station sites in the corridors and the Livermore-Amador Valley and over two dozen links connecting these stations. A recommendation was made in that report to limit more detailed comparisons to three Dublin Canyon lines because the margins of superiority of these lines in cost, traveler benefits, and urban environmental impact were so great that the consultants believed they could not be overbalanced by somewhat better ratings for San Ramon lines on natural environmental impact or possibly for evaluations not yet undertaken.

The Board requested additional studies in the San Ramon corridor, and particularly of additional downtown station sites in Walnut Creek, in order to determine the feasibility of this alternative in the event that downtown Walnut Creek were to attract much more employment than current economic projections envision. This could result from specific public policies other than BART location decisions or because a second BART line to Walnut Creek would induce regional offices to locate there. The results of these studies are presented in this report.

REJECTED ALTERNATIVES

For detailed discussion of the route and station alternatives evaluated and rejected, the reader is referred to the Preliminary Alternatives report, but the more significant decisions are described briefly here.

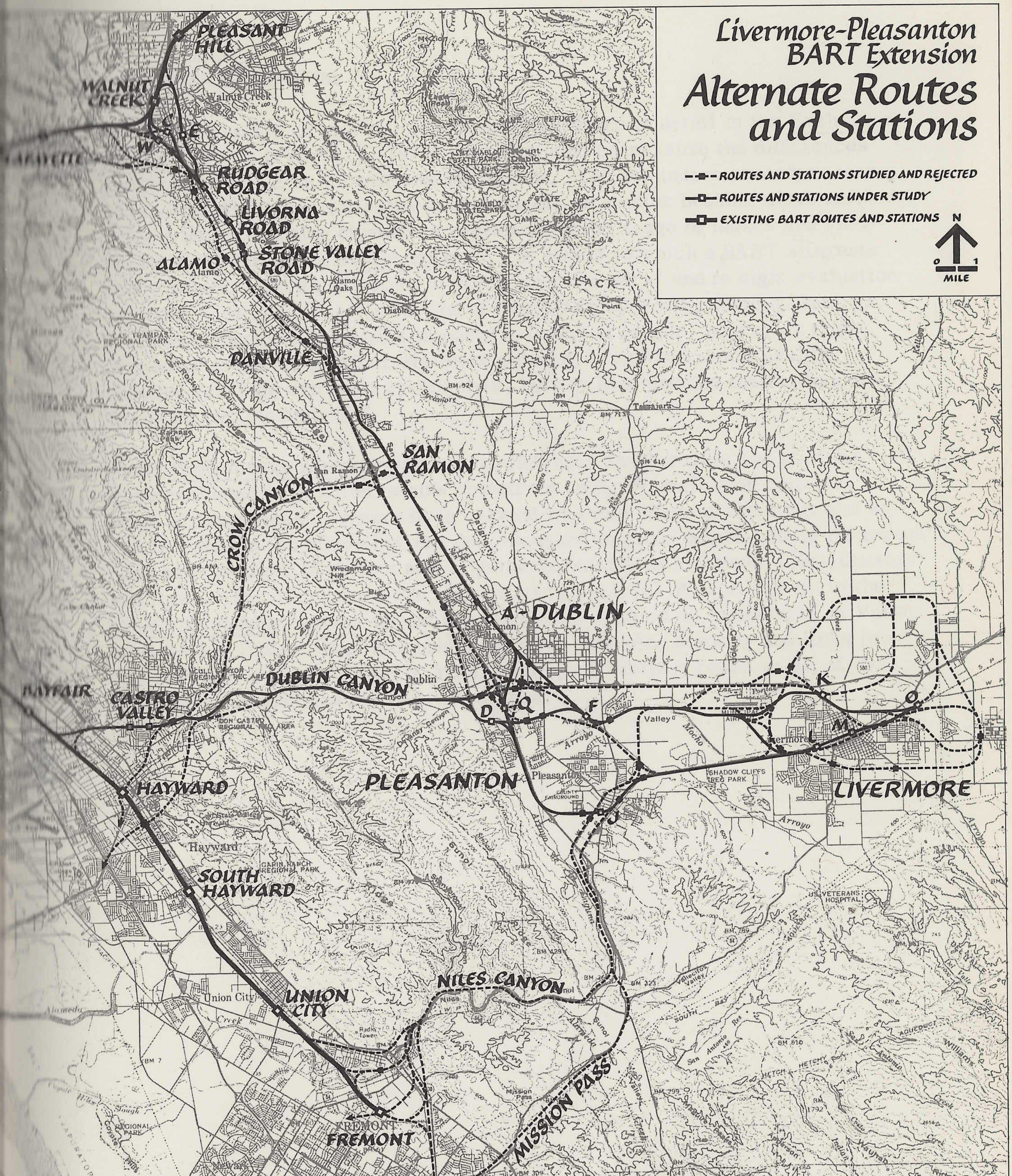
The Niles Canyon/Mission Pass corridor that would have involved a BART extension from the Valley to Fremont was dropped because of low patronage, high cost relative to patronage, longer travel time for most patrons, poor service to the Dublin-San Ramon area, and high environmental disruption. In the Valley two rejected station locations, in particular, warrant discussion. A station serving the Lawrence Radiation Laboratory would not generate more than 800 trips a day, hardly enough to justify a $20 million construction cost premium. A similar problem would occur at a station north of I-580 to serve the South County Junior College District campus, where a construction cost premium of $13 million would be necessary to serve 800 patrons. Since the undeveloped site is worth $1 milion, it would be preferable to bring the College closer to BART rather than BART to the College to obtain better rapid transit service. Three possible connections to the BART line in Hayward received attention but were subsequently rejected because of high cost, extreme disruption, and adverse travel for most Valley patrons. All of the rejected alternatives as well as the alternatives currently under study are shown on the map of alternate routes and stations on the following page.

SEPARATION OF CORRIDOR AND VALLEY STUDIES

Since completion of the Preliminary Alternatives report the study has concentrated on corridor planning issues and Valley planning issues separately for two reasons. First, a corridor decision is separable from a decision on Valley links and stations because most of these could be joined to the existing BART system through either corridor. Second, costs, traveler benefits, growth, and urban environmental impacts of a BART line in the Valley would vary depending on the corridor selected to tie into the existing system, so it is logical that a corridor decision be made first.

BUS ALTERNATIVE

With the concurrence of the BART staff it was decided that the bus transit (no-BART) alternative would be evaluated once a single BART line has been selecte Detailed studies of alternative bus systems prior to selection of a single route would have no real bearing on the comparison of alternate BART lines. Furthe more, analysis of patronage on conventional and exclusive lane bus systems must await completion of Task III of the Regional Transit Travel Projections Project, currently expected in February, 1974.


Livermore-Pleasanton
BART Extension
Alternate Routes and Stations
ROUTES AND STATIONS STUDIED AND REJECTED
ROUTES AND STATIONS UNDER STUDY
EXISTING BART ROUTES AND STATIONS
N
0 1
MILE
PLEASANT HILL
WALNUT CREEK
LAFAYETTE
W
E
RUDGEAR ROAD
LIVORNA ROAD
ALAMO
STONE VALLEY ROAD
DANVILLE
SAN RAMON
CROW CANYON
A - DUBLIN
DUBLIN CANYON
BAYFAIR
CASTRO VALLEY
D
Q
F
K
O
L
M
J
PLEASANTON
LIVERMORE
HAYWARD
SOUTH HAYWARD
UNION CITY
NILES CANYON
FREMONT
MISSION PASS

EVALUATION SYSTEM

Early in the study an evaluation process, described in detail in the Evaluation Criteria report (February, 1973), was designed to measure the differences among alternative BART stations and routes. The evaluation procedure was created to eliminate alternates progressively as studies became more refined using a set of planning objectives representing the range of issues and viewpoints identified in the Issues report. The extent to which a BART alternate would comply with an objective is determined by use of one to eight evaluation criteria. The most exact measure of compliance is dollar costs or savings. A second, measure quantifies impacts in terms of people, acres, or trips. For some criteria, particularly those relating to environmental quality, relative rankings are most appropriate, but far less precise than either of the other two measures.

In the Preliminary Alternatives report alternate BART routes and stations were evaluated in relation to nine objectives using 27 evaluation criteria. Most of these measures have been carried into this phase of the study and so are included in the tables but are not discussed in great detail. Some measures have been changed to reflect new alignments or station locations. New stations and links in the corridors were brought up to the level of detail shown in the Preliminary Alternatives report but were not evaluated as intensively as Valley stations and links. Once a corridor decision is made, stations and links in that corridor will be subject to a refined impact analysis based on all of the evaluation criteria and planning objectives.

REGIONAL DEVELOPMENT ALTERNATIVES

If rail transit is best suited to carrying employees to areas of high employment concentration within walking distance of a station, then it will increasingly serve office workers who form a growing percentage of all employed persons. To the extent that the location pattern of regional office complexes is influenced by transit accessibility, a BART extension can reinforce curren trends or give impetus to a change. In the Bay Area the alternatives are to increase the concentration of regional offices in downtown San Francisco and to a lesser extent in Oakland, or to promote the development of regional subcenters. The Association of Bay Area Governments' (ABAG) Regional Plan of 1970 advocates a city-centered concept consisting of a system of communities "large enough to be able to specialize economically", and suggests that "surrounding communities would be less dependent on the metropolitan center ABAG does not take a position on whether regional office employment should b centralized or decentralized.

Currently, the momentum is toward centralization of region-serving offices During the early 1960's San Francisco was adding less than 800,000 square feet of office space per year. Between 1968 and 1970 this increased to an average of 1.2 million square feet per year, and the current rate of increase is 1.6 million square feet and 9,000 jobs added each year. Between 1967 and mid-1971, 45 percent of the total value of office building permits in the nine county Bay Area was in San Francisco. The 20 year outlook in San Francisco is for addition of 1-1.2 million square feet of office space and 5,700-6,900 office jobs each year. Office employment gains will continue to be partially offset by the exodus of manufacturing and distribution industries to suburban locations. ABAG projects a net gain of only 48,000 jobs in downtown San Francisco between 1970 and 1990 (295,000 to 343,000). Oakland's central business district employment will increase by 37,000 according to ABAG (64,000 to 100,000).

Construction of BART has helped give impetus to further centralization as it was intended to do, but it would be an overstatement to say that BART is responsible.

Patronage projections indicate that a BART extension providing the best service to Oakland and San Francisco would attract the most riders. As well-paid offi workers must travel further to find new single family homes in homogeneous communities, their automobile commute becomes more onerous, and costly (or even impossible if there is a prolonged energy shortage) and they readily can be attracted to high quality transit.

If some of this regional office development could be directed to smaller centers in the region, total travel would be reduced. Retailing already is highly decentralized as are most services provided directly to consumers. So far, the Bay Area exhibits little tendency to form subregional office clusters such as those found in Westwood and Pasadena. When offices are built outside the regional core, as in Palo Alto or San Jose, the employees tend to live closer to their work places in a scattered pattern that is not well adapted to transit service. To be competitive under current conditions, outlying offices must be planned for full reliance on automobile travel. Once the automobile is accommodated, the employment density is too low for efficient transit service and the ease of driving and parking prevents transit from becoming competitive.

If regional policy were to discourage further intensification of development in the metropolitan core cities, BART should not have been built and should not be extended. It cannot help but favor additional development where high densities already exist. BART will cause relocation of some office development that would have occurred in outlying areas in any event, but it is unlikely to attract a significant amount of potential development from downtown Oakland and San Francisco to outlying BART-served locations. A decision to extend BART to Livermore and Pleasanton will reinforce a centralized regional office employment pattern.

REGIONAL DEVELOPMENT IMPACT OF BART SERVICE CORRIDORS

If present commute patterns are to be served most efficiently, Dublin Canyon is the obvious choice. Oakland or San Francisco will be the destinations of 63 to 75 percent of BART Valley commuters, and Dublin Canyon is 15 minutes faster than the San Ramon corridor to Oakland City Center. By minimizing commute time, the Dublin corridor favors continued expansion of employment in downtown San Francisco and Oakland. Conversely, if expansion in the metropolitan core is anticipated whether or not BART is extended, the Dublin corridor will minimize total travel and total automobile travel. The Dublin corridor would serve only Castro Valley in addition to the Valley communities. The 63,000 residents of Castro Valley (1990) would have improved BART service, but most of the potential patrons would use the Bay Fair station if the Dublin corridor line were not built. Assuming the Valley extension joins the existing line at Bay Fair, little additional development could be expected to result from BART. Although the Bay Fair regional shopping center adjoins the station and there is good freeway accessibility, the area lacks a positive image and there is little vacant land.

Choice of the San Ramon corridor would have some influence on the distribution of jobs, but there would be substantial disbenefits for many BART riders.

A BART connection to the Walnut Creek station could be expected to result in an increase of 1,900 jobs within walking distance of the station by 1990 (a 5 pe cent increase within the Walnut Creek General Plan area).

Development pressures in downtown Walnut Creek are expected to be strong with or without a BART extension. In spite of loss of central Contra Costa County retail dominance to Sun Valley shopping center, retailing in Walnut Creek remains healthy and the recent commitment of Bullock's to locate a new store in the central business district adds to its prestige. Lack of vacan land is not expected to curtail growth. Walnut Creek has been the location of new subregional office development, notably the new highrise Fidelity Savi Building adjoining the BART station. The community's prestige and convenien to high quality residential areas, its access to the regional core via freeway and the present BART line, and its confined downtown area that will force com pact development, all point toward a continuation of the trend. However, ther is no reason to believe that a BART connection would divert more than one or two percent of San Francisco's potential regional office employment gain duri the next 20 years. This doesn't mean it could not happen, but there is no basi for predicting a greater change as a result of a BART extension. If a sizable shift is not a likely possibility, there is little reason to connect the Valley to another area that is expected to have a large net out-commute rather than directly to the areas that have a surplus of jobs over living space.

To test the case for a BART line in the San Ramon corridor, the analysis in this report assumes that employment in downtown Walnut Creek will increase from 10,000 in 1970 to 35,000 in 1990, a figure exceeding ABAG projections by 60 percent.

VALLEY DEVELOPMENT ALTERNATIVES

Given the assumption that Valley population will increase from 100,000 in 197 to 178,000-227,000 in 1990 (see Framework section), what alternative forms might new development take? Since about half of the 1990 population already resides in the Valley, mostly in relatively new housing, the potential for chan in present trends will depend on the location and density of the 26,000 to 42,00 housing units to be added. If new housing occupies the same land per unit as existing housing and if commercial and industrial uses expand proportionately, 39 to 45 percent of the Valley's buildable land under 20 percent slope will be urbanized, compared with 28 percent today. Already tentative or final subdivi sion maps have been approved authorizing approximately 4,600 new units, 4,0 of which are single family homes. If maintenance of reasonably compact comm ities, each with its own identify, is an objective, continuation of market trends and present regulatory policies probably will achieve it. However, this patter

TABLE 1: VALLEY DEVELOPMENT ALTERNATIVES

	1972	1990 Low - Sharply Curtailed Growth	1990 High - General Plan Growth Rate Limitation	1990 High - Strong Shift to Higher Density Housing		
				New Community	Valley Remainder	Valley Total
Population	102,000	178,000	227,000	35,000	192,000	227,000
Single family housing units	26,300	41,700	46,100	0	35,500	35,500
High density housing units	2,800	13,900	24,800	11,700	23,800	35,500
Single family acres	6,800	11,000	12,200	0	9,400	9,400
High density acres	200	900	2,200	600	1,600	2,200
Total residential acres	7,000	11,900	14,400	600	11,000	11,600
Retail acres	400	660	840	60	730	790
Office acres	50	90	110	20	90	110
Industry acres	1,200	1,800	2,300	100	2,200	2,300
Quarry acres	2,600	2,600	2,600	0	2,600	2,600
Orchard acres	840	30	30	0	30	30
Vineyard acres	1,860	2,270	2,060	0	2,270	2,270
Community facilities acres	3,000	4,000	4,400	700	3,700	4,400
Major street, rail & utilities R.O.W.	2,950	2,950	3,550	100	3,450	3,550
Vacant developable acres	42,300	35,900	31,900	3,920	30,630	34,550
Total developable acres	62,200	62,200	62,200	5,500[a.]	56,700	62,200
Total urbanized acres[b.]	17,200	24,000	28,200	1,580	23,770	25,350
Per cent urbanized	27.7	38.6	45.3	28.7	41.9	40.8

a. Valley zones 36, 37, 38, 40, 41, 42, 43 and 44
b. Excludes orchard/vineyard

Source: Livingston and Blayney

will sharply reduce the amount of open space in the Valley and is less suited transit service than higher density development.

Table 1 describes existing land use and illustrates three Valley population a density alternatives that could be attained by 1990. In 1972 only 10 percent the Valley's housing was high density. Most high density units are apartmen few townhouse or zero lot line units have been built. Unless regulatory poli intervene, the ratio of high density units will increase sharply by 1990. The example of Santa Clara County, a rapidly developing and admittedly larger a more diverse urban area, illustrates a typical trend as maturity is approach In 1960 Santa Clara County had only 17 percent high density units, but during the 1960-70 decade 53 percent of the units built were high density and by 197 the high density share was 43 percent.

The reasons are rapidly rising housing costs, led by land costs, plus the ada ability of a greater proportion of the population to apartment living as fewer young unmarried people leave the community and the families who arrived early no longer have children living at home. If a sharply curtailed growth policy prevails in the Valley (178,000 population in 1990) the high density housing share might reach only 25 percent by 1990 as builders would seek to devote their limited share of permits to single family homes because the market would be strong and profit margins are higher. Under the more libe population assumption (227,000 in 1990) a high density share of 35 percent w be a likely expectation.

Using the same population projection and assuming a strong shift to higher density living, the non-single family detached share (multi-family, townhous zero lot line house, patio house, etc.) might reach 50 percent of the total stock. Under this assumption only 9,200 new single family detached homes would be built during the period, or 5,200 more than are already approved. About 78 percent of all new units built would be high density. Assuming an average density of 16 units per gross acre for the non-single family units, 1,360 more acres would be urbanized than with 178,000 people and 25 per cent high density, and 2,840 less acres would be used than with 227,000 people and 35 percent high density units. With housing costs rising faster than personal income, such a strong shift to high density living is not an unrealistic possibility, but it would require some changes in public taste and a quality of design of high density housing that is rarely found today. One of the changes in public preferences that would make it possible would be a desire to live within walking distance of BART. The shift will come only if encouraged by local development policies, but may receive impetus from the energy shortage. Support for such policies would be based on a desire to preserve open space and reduce dependence on the automobile, and probably

would be coupled with a program for large scale permanent preservation of open space either through acquisition or by allowing developers to build only on a small portion of their sites.

ROLE OF BART IN VALLEY DEVELOPMENT ALTERNATIVES

BART's main influence on the development pattern of the Valley will be in attracting housing built for a commuter market to locations near the stations. With two-thirds of Valley jobs held by persons living in the Valley and only 5 percent of intra-Valley work trips projected on BART, there will be little influence on the choice of residential location for the 45 percent of all Valley employed persons who are not out-commuters.

Only a portion of the available housing within walking distance of BART stations will be occupied by BART commuters. Assuming 43,700 out-commuters with one-third on BART, 14,400 commuters representing a total family population of 41,200 might want to live within walking distance. However, the proportion of commuter households that prefer and can afford single family houses is likely to be high. Better than 90 percent of present commuters live in single family houses. Land within walking distance of BART stations is expected to be priced too high for single family development. If, for example, only 25 percent of all BART commuters will accept high density housing, the total commuter household population wanting to live near stations would drop to 10,300 persons needing 3,400 housing units. All of the seats of stations under consideration could accommodate at least twice that much housing.

If all new Valley residents who are out-commuters wanted to live within walking distance of BART, there would be a demand for 23,400 housing units near stations. Since only one-third of the out-commuters are projected to be BART riders, the demand would drop to 7,700 nearby units, close to the 7,200 to 7,600 unit capacity range of the areas within walking distance of four Valley BART stations. Of course not all housing near BART stations will be occupied by BART riders. By 1990, 11,000 to 22,000 high density units are expected to be built in the Valley without any major shift to high density. Since rental units would benefit from locations attractive to BART commuters even though many tenants would not use BART, the areas within walking distance of the stations would be fully developed. Thus, under a projection of probably trends, BART's major influence on urban form would be to cause about half of the new high density housing to cluster near stations.

While there is no evidence to show that BART would cause a shift in housing types, a strong shift to higher density probably could not be accomplished without BART. An important element in attracting a larger share of the new

population to high density housing would be a desire for reduction of dependence on the car, whether for reasons of convenience, cost, or fuel shortage.

If 78 percent of the residents added by 1990 live in high density housing (50 percent of all residents) and 59 percent of new employed persons commute outside the Valley (55 percent of all employed persons) it seems reasonable to assume that 50 percent (instead of 33 percent) of these new commuters might ride BART if it were sufficiently convenient. This would create a market for housing for 29,200 persons within walking distance of BART, exceeding the capacity adjoining four Valley stations if all nearby residents were BART commuters.

This potentially unsatisfied demand for housing near BART would provide the opportunity to create a "new community" with maximum orientation to transit. With imaginative planning, 35,000 people could live in 11,700 housing units at 20 units per acre all within walking distance (assisted by moving sidewalks and horizontal elevators). A possible site would be north of I-580 at Livermore where the community might logically be within the Livermore city limits and would be 48 minutes by BART from Oakland City Center via Dublin Canyon. If the BART-oriented community were completed by 1990, the remainder of the Valley would be composed of 40 percent high density housing, only 5 per cent above the share projected with no conscious effort to shift to high density, but there would be 2,800 acres (4 square miles) of additional open space and 4,400 fewer daily one-way commute trips on the highways, the equivalent of more than a freeway lane capacity.

Development of the new community could not start before BART service. If it were to be fully developed between 1980 and 1990 it would have to attract 10 percent of the population gain in Alameda and Contra Costa Counties (ABAG moderate growth projections) and half of the Valley growth during the period. These are high but not unattainable shares.

Retailing and offices will attract mainly intra-Valley trips, few of which BART would carry, and therefore will not concentrate near BART stations except to serve population in the immediate area. The exception would be that if a BART station enhances the identification and prestige of a commercial complex that is viable without BART, some additional office development may be attracted. In 1990 a maximum of about 12,500 jobs (25 percent of all Valley jobs) are likely to be located within walking distance of Valley BART stations if a line with the set of stations having the greatest employment potential were selected. If one-third of all Valley jobs are held by in-commuters and one-fifth of these employees ride BART, there would be 2,600 BART in-commuters in 1980. If

five percent of intra-Valley work trips were via BART, there would be an additional 1,800 patrons. Since those who could walk to work from a BART station are more likely to use BART, it seems reasonable to project that 1,000 to 2,200 of those employed near stations would be BART riders.

Within the range of BART's potential to influence or make possible alternate patterns of Valley development, there is no urban form that will drastically reduce dependence on the automobile. The 227,000 residents in 1990 will generate on the order of 700,000 trips a day in the Valley (10 per housing unit). If BART were to carry 50,000 trips a day out of the Valley, exceeding line capacity with 6 minute headways and far surpassing projections, it would account for only 7 percent of all trips. Local bus systems in similar communities typically carry one to two percent of all trips. Even in a high density city such as San Francisco that has intensive transit service, only 20 percent of all trips are on the Muni. However, BART's ability to relieve peak period congestion and improve the quality of life for both users and non-users should not be underemphasized. With one-third of the out-commute work trips on BART, four less freeway lanes would be needed in 1990 than with no transit.

As an illustration of the theoretical maximum capability of BART to reduce automobile usage, assume that a new community and all of the land within walking distance of the four stations with the highest residential development potential were at population holding capacity in 1990, accommodating 54,000 persons. If these people made no automobile trips at all, and 10 percent of the trips generated by other Valley residents were diverted to transit, the total number of vehicles trips would be 32 percent less than with no transit.

ATTITUDES TOWARD BART AND DEVELOPMENT ALTERNATIVES

In February, 1973, Gruen Gruen & Associates, Economic and Sociological Consultants, San Francisco, conducted a telephone survey of a random sample of 383 households in Livermore, Pleasanton, Dublin, Danville/Alamo, and Castro Valley. Tabulations and interpretations of responses to the 34 questions are contained in a 50 page report. Highlights pertinent to the route selection decision follow:

> In Livermore and Pleasanton about 90 percent of the respondents wanted a BART extension, but in Castro Valley the proportion favoring dropped to 57% and in Danville/Alamo to a bare majority of 51 percent.
>
> Among husbands commuting to San Francisco 47 percent would use a BART extension regularly, as would 35 percent of those employed in Oakland and 23 percent of Hayward/San Leandro workers.

Sixty percent of Valley residents who expressed a corridor preference favored Dublin Canyon.

Two-thirds of Livermore and Pleasanton respondents wanted the local BART station located outside of downtown. Only 15 percent thought their downtown purchases would increase if a BART station were there.

In the Valley, 31 percent of the respondents would be willing to pay more to live within walking distance of a station.

In Pleasanton 42 percent of respondents had a moderate or strong desir to limit population growth, while in Livermore only 27 percent expresse those views.

When asked whether they would favor a BART extension if it attracted an increase in apartment development, 49 percent of Valley residents expressing an opinion said that they would.

Two-thirds of Dublin and Pleasanton residents would prefer any population increase to be housed in single family subdivisions similar to those recently built rather than in garden apartments or townhouse clusters with large visible open spaces. In Livermore only 49 percent felt that way.

Less than half of Valley residents were willing to accept any tax increas to preserve large areas for permanent open space.

A survey of 502 Livermore residents conducted later in the year by Corey, Canapary & Calanis as a basis for revision of the City's general plan found BART and better local transit as the second most frequently cited community need.

In summary, a BART extension has strong support in the Valley but only moderate support in the access corridors where respondents probably anticipate disruption without a significant gain in transportation service. Many Valley residents have an anti-growth viewpoint, and most are strongly desirou of maintaining current dominance of single family housing. If BART means more apartments, its desirability becomes a close question. The survey was not able to explore views toward BART if residents were to assume that the proportion of apartments in the Valley increase greatly with or without BART and that the presence of BART would cause apartments to be concentrated near stations and would minimize vehicle miles of travel.

FRAMEWORK FOR ANALYSIS

POPULATION

Projections of population, economic activity and land use provide the basic framework for analysis of BART impacts. For this study it is assumed that population growth will be governed by a combination of local development policies and state and national environmental quality concerns rather than by unrestrained market demand. Population projections under three sets of policies, previously published in the Issues report and the Preliminary Alternatives report and summarized in Table 2, show the Valley population (including San Ramon) increasing from 100,000 in 1970 to a range between 178,000 and 227,000 in 1990. Projections prepared by the Alameda County Planning Department are 4 to 10 per cent higher for the Livermore-Amador Planning Unit.

For planning areas outside the Valley Metropolitan Transportation Commission (MTC)/Association of Bay Area Governments (ABAG) Series Two population projections produced by the Projective Land Use Model (PLUM) for the Regional Transit Travel Projections Project (RTTPP) have been used. In the Valley the baseline projections are roughly equivalent to the consultants' full development projection of 240,000 in 1990 (Table 2). Because these projections reflect the broad framework provided by the ABAG Regional Plan 1970: 1990 and have not been subject to rigorous planning evaluation, they do not represent probable trends of future development everywhere. However, they do provide a consistent framework for analysis of BART impact in the corridors.

Total 1980 and 1990 population tributary to BART lines extending through the Dublin Canyon corridor to the Valley or through the San Ramon Corridor to the Valley is shown in Table 3. The Valley population estimate refers to all those living in the Livermore-Amador-San Ramon Valley, while the corridor populations count all persons living within two and a half miles of a BART station in the corridor who are not included in the Valley population projection.

These projections will be affected by several fast changing phenomena that cannot be predicted with confidence. Foremost in everyone's mind today is the energy crisis. With an energy shortage more growth pressure might occur in communities served by rapid transit, but overall regional growth could be less than currently expected if the regional and national economies enter a recession

TABLE 2: LIVERMORE-AMADOR-SAN RAMON VALLEY POPULATION PROJECTIONS

	1970	1980	1990	2000	Hold Capa
Full Development[a.]	86,000	175,000	240,000	303,000	414,
General Plans and Growth Rate Limitations[b.]	86,000	169,000	227,000	292,000	359,
Sharply Curtailed Growth[c.]	86,000	145,000	178,000	210,000	252,

a. Full Development: Projects growth applying typical subdivision densities suited to topography to all potential residential land shown on general plans and other lands with less than 20 per cent average slope, assuming recent growth rates (Livermore, 760 housing units added per year; Pleasanton, 1,000; Dublin, 200; San Ramon, 500). This alternate assumes that the vineyards will not be retained and that, as in the Santa Clara Valley, general plan proposals will not prevail.

b. General Plans and Growth Rate Limitation: Projects growth in accord with the current general plans for Livermore, Pleasanton, Dublin (Alameda County), San Ramon (Contra Costa County), assuming 800 housing units added per year in Pleasanton and growth rates in other areas at the same levels as in the full development alternative.

c. Sharply Curtailed Growth: Projects growth subject to limitations on both rate and total holding capacity of the Valley. Livermore: All open space shown on County Open Space Plan, rural and estates residential areas, other lands further than one half mile from existing development, and an additional 1,500 acres of flat land remain open; 500 housing units added per year. Pleasanton: All lands south and east of the present City boundary and 500 additional acres of flat land remain open; 500 housing units added per year. Dublin: Proposed low density areas in the hills remain open; 200 housing units added per year. San Ramon: Proposed low density areas in the hills and the area designated for medium density development along Dougherty Road remain open; 400 housing units added per year.

Source: Livingston and Blayney

TABLE 3: TOTAL TRIBUTARY POPULATION TO ALTERNATE BART LINES

	1980		1990
Dublin Canyon Lines			
Valley population	169,000		227,000
Corridor population	46,300		52,400
Total	215,300		279,400
(Ten year average growth rate)		30%	
San Ramon Valley Lines			
Valley population	169,000		227,000
Corridor population	85,100		130,300
Total	254,100		357,300
(Ten year average growth rate)		41%	

Source: Valley population projections: Livingston and Blayney
Corridor population projections: MTC/ABAG

and migration to major coastal metropolitan areas drops off significantly. Air pollution control strategy could limit growth in the Valley, particularly if energy conservation concerns postpone deadlines for reduction of automobile emissions and the improvement of Valley air quality that is expected. Local attitudes toward development and the ability of communities to extend sewer service to new development likewise will have a significant impact on future population growth. The amount of federal aid for expansion of sewage treatment capacity will depend on environmental policy, revenue sharing policy, and national economic conditions. The constitutionality of local restictions on growth rates currently is being tested in the federal courts.

Because these issues will not be resolved soon, the projections used in this study should be regarded only as assumptions to be used to examine BART impacts and compare alternative BART extensions.

EMPLOYMENT

The following 1990 local employment and commuting projections are used as the basis for travel analysis.

227,000 population, 1990
79,450 employed residents, 1990 (35 per cent of population vs. 34 per cent, 1970)
43,700 employed residents commuting out of the Valley, 1990 (55 per cent vs. 48 per cent in 1970)
17,750 local jobs held by in-commuters (33 per cent, same as in 1970)
5,500 employees at the Livermore Radiation Laboratory (constant).

The employment composition forecast reflects a judgment of the mix of economic activities that is likely to be found in the Valley at the stages of economic maturity through which it will be passing. Local employment projections by industry group are in Table 4. For planning areas outside the Valley MTC/ABAG Series Two employment projections were used for analysis of BART impact except in Walnut Creek.

Walnut Creek Employment Assumption

During review of the Preliminary Alternatives report the question of how a policy favoring development of Walnut Creek as a strong regional subcenter would affect the feasibility of a BART line in the San Ramon corridor emerged as critical. With a BART extension to the Valley and two downtown BART stations, Walnut Creek's potential as a regional subcenter could be reinforced.

TABLE 4: EMPLOYMENT PROJECTIONS LIVERMORE - AMADOR-SAN RAMON VALLEY

	1970[a]		1980		1990	
Total	22,800	100.0%	39,900	100.0%	53,500	100.0%
Agriculture	1,600	7.0%	1,300	3.3%	1,000	1.9%
Construction	700	3.0%	1,000	2.5%	1,200	2.2%
Manufacturing	1,900	8.3%	5,500	13.8%	7,700	14.4%
Transportation, Communication & Utilities	400	1.8%	500	1.3%	600	1.1%
Trade	2,500	11.0%	6,200	15.5%	9,300	17.3%
Finance, Insurance & Real Estate	700	3.0%	1,400	3.5%	2,100	3.9%
Services	5,000	22.0%	9,600	24.0%	13,800	26.0%
Government[b]	4,400	19.3%	8,700	21.8%	12,000	22.4%
Other	100	.5%	200	.5%	300	.5%
Radiation Laboratory	5,500	24.1%	5,500	13.8%	5,500	10.3%

Source: Keyser/Marston and Associates

a. Alameda County portion of Valley employment from California Department of Human Resources Development; Contra Costa County portion of Valley employment from Keyser/Marston and Associates estimate.

b. Excludes Radiation Laboratory

To test the implications of intensive development on BART design and patronage an alternative high growth employment assumption was made for downtown Walnut Creek, assuming a BART extension to the Valley.

In 1970 10,300 were employed in central Walnut Creek. The 1990 MTC/ABAG employment projection for the downtown area is 22,000, with most of the increase occuring in retail and office employment. This employment gain would occupy the equivalent of 10 high-rise office buildings larger than any now in Walnut Creek and two or three major department stores.

To test the impact of the maximum increase that reasonably could occur, the City Planning Department and the consultants jointly agreed to assume 35,000 downtown jobs in 1990 based on the capacity of the local street system. The 13,000 additional jobs would be distributed equally between retail trade and services and offices. If the offices were all in high-rise buildings within walking distance of BART stations, 13 additional structures of 100,000 square feet each (typically 10 stories) would be built.

The preliminary economic analysis of the impact of a BART extension connecting to Walnut Creek prepared for the Preliminary Alternatives report projected an increase of only 1,900 jobs within walking distance of a BART station (an eight per cent increase in the projected downtown employment). The 35,000 job assumption represents a seven-fold increase in that projection and is not based on economic analysis.

The BART patronage impact of the assumption is described in the following section.

REGIONAL TRANSIT TRAVEL PROJECTIONS PROJECT (RTTPP)

The Livermore-Pleasanton BART Extension Study relies on RTTPP for projections of patronage. Task 1 of RTTPP, completed in January 1973, produced order of magnitude corridor estimates that were incorporated in the Preliminary Alternatives report. These projections were intended to guage the relative service provided by alternate corridors and were based on high and low estimates of the propensity for travelers to choose public transit. These initial projections were at a gross level using Bay Area Transportation Study (BATS) data, more recent MTC/ABAG employment forecasts, Department of Finance population projections (Alternate C-300) and population projections for the Valley supplied by the consultants. The entire Valley was treated as one zone with similar travel characteristics.

The preliminary patronage projections were designed to evaluate a wide range of corridor alternates. In addition to the Dublin, San Ramon and Niles corridors, the tests for patronage included assumption of a San Mateo BART line to Menlo Park in one case and a completed San Mateo-Santa Clara County loop around the south bay to Fremont in another case. A third alternative involved a route from Fremont across the Dumbarton Bridge to Menlo Park and through San Mateo County to the Daly City BART station. The preliminary work trip partonage results for projections at the maximum patronage point on each alignment is presented in Table 5 . Three sets of projections were prepared: high and low forecasts for 1980 and a high forecast for 1990. The HITRANS projections assume that BART riding time is more desirable than bus riding or auto driving time and has a 25 per cent lower value while the LOTRANS projections assign equal value to time spent riding or driving.

TABLE 5: RTTPP CORRIDOR PARTONAGE PROJECTIONS
(Average Daily Work Trips Based on Trip-end Summaries)

	1980 LOTRANS	1980 HITRANS	1990 HITRANS
Dublin Canyon Corridor	15,391	20,701	
- with South Bay Loop			29,177
San Ramon Corridor		18,675	
Niles Canyon Corridor		12,158	
- with Dumbarton crossing			30,035

It is not possible to determine from available data what proportion of the 1990 trips are attributable to the South Bay Loop or the Dumbarton crossing.

For the only comparable set of assumptions, trip-end summaries for Dublin Canyon exceed Niles Canyon by 70 per cent and San Ramon by 11 per cent. However, RTTPP does not show that total BART patronage is sensitive to corridor selection, probably because the analysis zones are so large. The total number of BART work trips produced and attracted with BART in alternate

corridors varies by less than one per cent of the total work trips in the study area. Thus, the apparent assumption is that BART patrons who would not be well served by a Niles corridor line would board BART at Bay Fair or Walnut Creek. The model also indicates little dependence on corridor selection in the BART 1980 work trip attractions to the possible points of connection. When alternate corridors are assumed, BART trips attracted to Walnut Creek, Hayward, and Fremont vary by less than one per cent of all trip attractions.

Transit accounts for about 13 per cent of all trips produced in the study area and about 5 per cent of all trips attracted. The maximum share of intra-Valley trips on transit is 5 or 6 per cent. RTTPP projections show one-third of the outbound commuters and one-fifth of the inbound commuters using BART. Trip tables show that 63 to 75 per cent of the outbound commuters using a Valley extension are headed for Oakland or San Francisco.

For this phase of the study BART has estimated the 1980 total daily trips expected on Dublin Canyon lines to be 27,600 and on San Ramon lines to be 22,700. These estimates include shopping, recreation, and business trips originating or terminating on the BART extension in addition to work trips.

During discussion of the Preliminary Alternatives report members of the Livermore-Pleasanton BART Extension Project Technical Advisory Committee questioned whether a longer term view of the need to link regional sub-centers might be in the regional interest to reduce growth pressures and employment concentration in Oakland and San Francisco and avoid overloading the existing BART system. Would a BART extension from Walnut Creek through Dublin and Fremont to San Jose achieve these objectives and, if so, would a Dublin Canyon Corridor extension effectively foreclose ultimate development of such an extension? A test using MTC/ABAG regional development and travel projections showed that in 1990 nearly 2,500 hours of additional travel time per day would result if the San Ramon and Niles Canyon lines were built in lieu of a Dublin Canyon extension. Furthermore, this transit extension would have an $18 premium per individual work trip over a twenty year period.

RTTPP III. Following development of preliminary patronage projections, work on a more refined series was begun by MTC and BART. In this cycle procedures were refined to include more detailed descriptions of trip-making behavi and smaller analysis zones. Specific alternative corridor alignments and service characteristics were developed. Five travel modes were to be evaluated using ten alternate growth assumptions and network alternatives for 1990. The alternatives to be studied for the Valley are shown in Table 6 . In addition to

TABLE 6: RTTPP III TESTING FRAMEWORK

Test	1990 Growth Alternative	1990 Network Alternative
1	Low	Conventional bus service in all three corridors
2	High	Rapid transit-Dublin Canyon, Valley southern route, conventional bus service in other two corridors
3	Low	Rapid transit-Dublin Canyon, Valley southern route, conventional bus service in other two corridors
4	High, modified with greater Walnut Creek CBD Employment	Rapid transit San Ramon Valley Conventional bus service in other two corridors
5	High	Rapid transit-San Ramon Valley, Valley southern route, conventional bus service in other two corridors
6	High	Rapid transit-Dublin Canyon, Valley southern route, conventional bus service in other two corridors
7	High, modified for transit-oriented new town	Rapid transit-Dublin Canyon, Valley northern route to new town, conventional bus service in other two corridors
8	Low	Exclusive busway-Dublin Canyon, conventional bus service in other two corridors
9	Low	Conventional bus service in all three corridors
10	High	Conventional bus service in all three corridors

BART and bus alternatives connecting with both corridors, alternative land use patterns are considered. Two alternates (1990 high and 1990 low) assume distribution of population and employment in accord with current general plans. A third alternate assumes creation of a high density transit-oriented new community north of Livermore.

Effect of Walnut Creek Employment Assumption. A key question is whether the high employment assumptions for downtown Walnut Creek would materially alter relative patronage in the Dublin and San Ramon corridors. Accordingly, assumptions were made about the likely residential locations of employees added in downtown Walnut Creek. A 1968 survey showed that 4.8 per cent of persons working in central Walnut Creek lived in the corridor to the south and 5 per cent in Alameda County. Over thirty per cent of downtown employees lived in Concord, Lafayette, or Pleasant Hill and another 25 per cent in Martinez, Moraga or Orinda. Since that time, growth has filled in much of the available land in Walnut Creek and immediately east, north and west. It seems likely that if 13,000 employees were to be added in Walnut Creek, a larger share of them would reside to the south because of land availability. If 50 per cent of the new jobs would be held by Valley residents and 35 per cent would take BART, 4,100 work trips would be added to a San Ramon Valley line. There also would be some increase in shopping, recreation, and business trips. The BART staff has estimated that non-work trips might result in total patronage 20 per cent higher than the work trip volume raising the potential gain to 4,970 rides per day. This is presented as a "high" projection.

Based on BART's projection of total 1980 trips developed from RTTPP first cycle figures, a San Ramon line would have 31,700 riders in 1990, assuming a 1980-90 increase of 40 per cent that would match the projected increase in tributary population. Adding the 5,000 additional trips projected if the downtown Walnut Creek 1990 high employment assumption were attained would raise San Ramon patronage to 36,700. Dublin Canyon, with a lower 30 per cent 1980-90 growth, would carry only 35,900 passengers in 1990 if patronage retains a constant ratio to population.

BART OPERATIONS POLICY

Three options are available for operating trains on extensions of the basic BART system consisting of the Daly City-Concord, Daly City-Richmond, Daly City-Fremont, and Richmond-Fremont lines.

Option 1 entails adding a Livermore-Daly City, Livermore-Richmond, or Livermore-Concord line to the basic system.

Option 2 involves splitting service on the basic system and merging the trains from the extension with those on the main line without increasing the number of trains on the main line.

Option 3 calls for shuttle service on the extension line to a transfer station on the main line.

Selection of the most appropriate option is dependent on the capacity of the basic system, service and schedule balancing, and policy decisions regarding acceptability of transfer and of splitting main line service. Capacity of the basic BART system is constrained by the Transbay Tube, the Oakland Wye and the Daly City station. Design of the BART system was based on the assumption that 90 second headways during peak period operation would be possible. However, operating experience progressively has increased estimates of attainable minimum headway. Headways below 3-1/3 minutes do not appear practical with the existing turnback facilities at the terminal stations (excepting Richmond). With modifications, including reconstruction of tracks at these stations, peak period headway may be reduced to two minutes by the time a Livermore-Pleasanton extension could be in operation.

The Regional Operations Issues Report prepared by BART states that peak period headways eventually may be reduced from two minutes to 90 seconds, but "routing of additional service lines through these areas (Transbay Tube and Oakland Wye) is not practical."

It is anticipated that the Concord Line will not have sufficient capacity to accommodate the projected 1990 patronage of a Valley extension via the San Ramon Corridor if peak period headways on the Concord Line remain at six minutes. This capacity deficiency could be overcome by decreasing the headway to three minutes, possibly by operating a Concord-MacArthur shuttle. However, BART has termed this alternative unacceptable because such a shuttle service would leave no margin for flexibility in response to minor service and operational variances. On the Fremont Line an overload is not anticipated on Richmond-bound trains, but Daly City-bound trains would have standees.

Ideally, an expanded system would not reduce the level of service or increase the headways on the basic system. However, patronage on new segments may warrant turning back or splitting service at intermediate points, such as Daly City, Bay Fair or Walnut Creek. For example, if BART is extended to the San Francisco Airport, it may be desirable to turn back one of every three trains at Daly City. As a second example, if BART is extended to the Valley from Bay

Fair, some trains might be routed to Livermore, although this would reduce service to Fremond Line stations south of Bay Fair.

The issue of transfer versus direct service must be evaluated in terms of the trade-offs between operating alternatives and the marketing aspect of the total regional system and, in particular, the extension under consideration. In general, transfers are inconvenient, and transfer stations must be designed to minimize inconvenience to patrons.

Under Option 1 an additional train would be introduced on the main line downstream from the merge point. If this train is routed directly to Daly City, the headway through the Transbay Tube must be reduced to 90 seconds. This probably can be achieved only by building a new transbay crossing. If a Valley train is routed directly to Richmond via Bay Fair or to Daly City via Walnut Creek, it would be necessary to reduce headways to 90 seconds or provide a third and fourth track through the Oakland Wye. In any case, the merger of the extension line with the main line would create train control problems. Decreasing the headway on the main line would have the added benefit of increasing its capacity and reducing the number of peak hour standees – especially on the Concord Line.

Under Option 2 service would be reduced on the outer legs of the basic system. For example, peak period headways on the Fremont Line south of Bay Fair would be increased from three to six minutes with one half of the trains routed to the Livermore Valley extension via Dublin Canyon. Thus, the average waiting time for a train south of Bay Fair would be increased. The train control problems introduced by the merge would not be as severe as in Option 1 because main line headways north of Bay Fair could remain unchanged.

Option 3 would not provide a direct connection between the main line and the extension other than for service to the Hayward yard. All passengers from the extension would transfer at Bay Fair or Walnut Creek. An independent shuttle service would avoid any new train control problems on the basic system, and close scheduling and proper design of the transfer station could minimize passenger delay and inconvenience. As in Option 2, main line capacity would not be increased.

Since BART operations policy strongly favors Option 3 (transfer to the main line), this option was assumed in comparing the Dublin Canyon and San Ramon corridors. If BART operations policy should change in the future, Option 1 would be the most beneficial for transit patrons. Not only would this option eliminate transfers for most riders, but it would increase main line service by adding another line. Because the transfer time penalty is identical for both the San Ramon and Dublin Canyon corridors, this factor does not affect comparison of the alternatives.

CORRIDOR ROUTES AND STATIONS

DUBLIN CANYON CORRIDOR

Route Description

From Bay Fair the extension line would proceed southward on aerial structure along the east side of the existing Fremont Line, pass under the westbound freeway roadway and enter the median of State Route 238 west of Mission Boulevard. The line would proceed at grade in the median of State Route 238 to the 238/580 interchange, and then continue in the median of the reconstructed I-580 freeway to a Castro Valley station located either near a southerly extension of Lake Chabot Road or near Redwood Road. From Castro Valley, the BART line would continue at grade in the median of the reconstructed I-580 freeway through Dublin Canyon. No other stations would be located in the corridor because there are no sites suitable for urban development.

West of Foothill Road in Dublin BART would rise on aerial structure, cross over the eastbound freeway lanes, proceed southward along Foothill Road and then turn eastward and continue on aerial structure to Station D located north of Stoneridge Drive and south of proposed Stoneridge Shopping Center.

Impact of Operations Policy

An operations policy that does not permit connecting an extension directly to the main line will create delay and inconvenience for transferring passengers. By careful scheduling the delay for a passenger transferring from a Livermore train to either a Daly City or Richmond-bound train can be minimized. However, since peak period headways average three minutes on the Fremont Line and would be six minutes on the Valley Line, only every second main line train can meet a Livermore train. For example, if the Richmond train (at six minute headways) were scheduled to meet every Livermore train, the average waiting time for a Daly City train would be three minutes. The required transfer at Bay Fair would reduce the potential usage of the Castro Valley Station because a large number of Castro Valley residents would find it more convenient to drive directly to Bay Fair rather than drive to Castro Valley Station and then endure the inconvenience of a transfer at Bay Fair.

BART's 1980 patronage projections for the existing system indicate that during peak periods there will be standees on the Fremont-Daly City Line, but empty seats on the Fremont-Richmond Line. The addition of the patronage generated by the Valley Line to the Fremont-Daly City Line at Bay Fair would fill available seats, causing virtually all peak period transbay patrons boarding at stations north of Bay Fair to stand.

Alignment Alternatives

For purposes of evaluating this corridor, it has been assumed that I-580 will be rebuilt to include an 80 foot median. Alternatives assuming BART on an independent alignment were not studied. In the proposed reconstruction of I-580 through Dublin Canyon, described in the Final Environmental Impact Statement (EIS) currently under consideration by the U.S. Department of Transportation (DOT), the California Department of Transportation (CALTRANS), proposes an 80 foot median in an eight lane freeway instead of the normal 30 foot median. Forty feet of the median would be available for a BART line, but also could be used for future additional freeway lanes, reversible express lanes, or exclusive bus lanes if BART is not built, or during the interim until BART is built.

Currently at issue in the review of the EIS is the number of lanes in the reconstructed freeway, and the effect of increased traffic capacity on population growth and air pollution in the Valley. Although eight lanes may not be built, it is reasonable to assume that some improvements to this segment of I-580 will be made, and that an 80 foot median will be included. Traffic problems justifying reconstruction include higher than average truck traffic (16 per cent), low design speed, and at grade intersections along the route. The affected local governments support the project. Furthermore, this route is the last remaining link in the Interstate Highway System between San Diego and Oakland, and is the major truck route between the Central Valley and the Bay Area.

Separate freeway and BART rights-of-way would greatly increase environmental disruption in Dublin Canyon. A joint transportation corridor appears to be the only logical solution, even if a freeway narrower than the proposed 196 foot shoulder to shoulder section is built. Use of the median offers an important potential cost saving to BART or any other transit agency, such as AC Transit, that might use the median.

Connection Alternatives

In addition to a Bay Fair connection, three alternative routes and transfer points to the Fremont Line were studied and rejected:

1. Turning BART south into the existing Fremont Line north of Hayward.

2. Bringing BART from I-580 along Redwood Road on aerial structure to A Street and thence by subway to the Hayward Station with a possible future extension west across the Bay.

3. Turning BART into the median of the proposed Route 92 Freeway (planned for construction after 2000) to a transfer station on the Fremont Line, a northward connection to the Fremont Line, or an extension across the Bay.

Alternatives 1 and 2 would have enhanced the potential for attraction of regional office employment to the vicinity of the existing Hayward Station, but all three were rejected because of high displacement and construction cost, disruption, and out of direction travel that would be required for most Valley patrons.

Bay Fair Connection

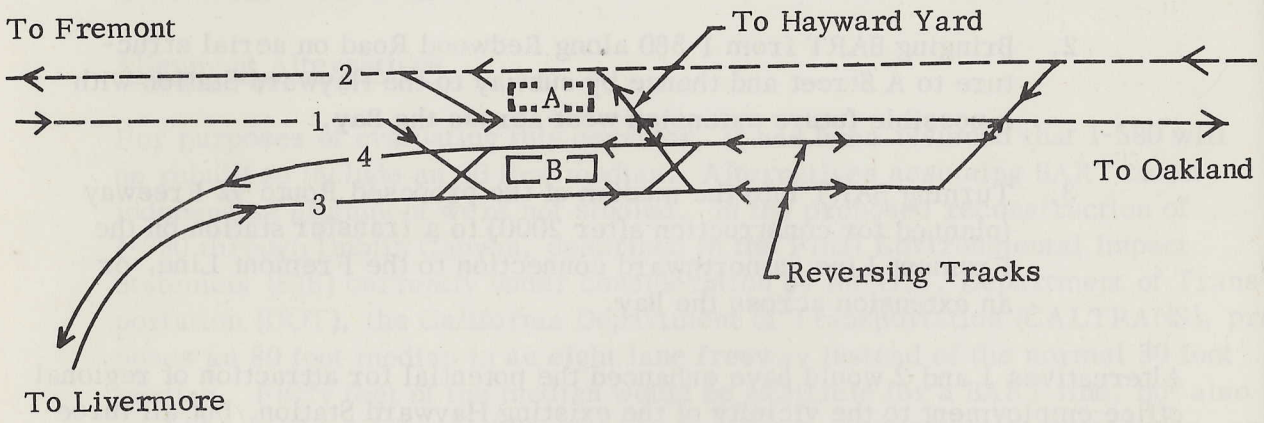
Two alternative connections to the Fremont Line at Bay Fair Station were studied, both approaching from the south. The presence of the W.P. track immediately west of the Fremont Line limits feasible connection arrangements. The Valley extension must adjoin the east side of the Fremont Line, displacing 53 housing units and the Eden Japanese Community Center between I-580 and Bay Fair Station.

The least expensive alternative would require Valley passengers to change levels in the station, while the more desirable alternative would allow transfers across the same platform. Detailed descriptions keyed to the diagrams follow.

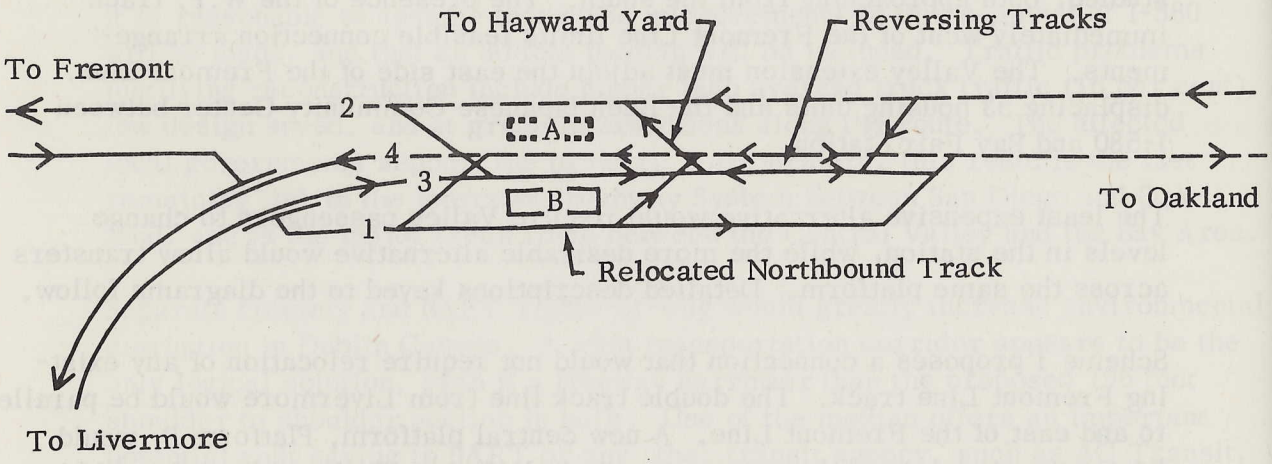
Scheme 1 proposes a connection that would not require relocation of any existing Fremont Line track. The double track line from Livermore would be parallel to and east of the Fremont Line. A new central platform, Platform B, would be constructed east of the existing central platform, Platform A, and would be used by Valley passengers. The transfer between the Valley Line and Fremont

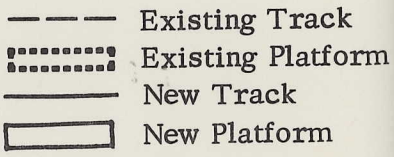
BAY FAIR STATION
CONNECTION ALTERNATIVES

SCHEME 1



SCHEME 2





Line would be at the mezzanine level, requiring passengers to descend and then go back up. Two tail tracks would extend north of Platform B. Track 4 would be a reversing track and Track 3 would provide temporary train storage and access to the Hayward Yard. Double crossovers at each of the new platforms would allow maximum flexibility.

Trains from Livermore would approach on Track 3, unload passengers on Platform B, proceed to Track 4 via the north crossover, reverse on Track 4, re-enter the station and load passengers at Platform B and return to Livermore on Track 4. Livermore trains headed for the Hayward Yard would reverse on Track 3, cross over Tracks 4 and 1 north of the platforms, and merge with southbound Track 2 north of Platform A. Trains returning from the Hayward Yard could use a crossover at either end of Platform B to reach Track 4, reverse direction, and proceed to Livermore.

With minor modifications, it would be possible to provide connection to the Fremont Line, north of the reversing tracks, allowing direct service to Oakland and either Richmond or Daly City. Westbound trains from Livermore would approach on Track 3 and merge with northbound Track 1. Southbound trains to the Valley would switch from Track 2 across Track 1 to Track 4. Passengers would be picked up and discharged at Platform B. This scheme has the drawback of requiring a crossover on the main line or construction of a grade separation.

Connection Scheme 2 would eliminate most of the operational disadvantages of Scheme 1. The transfer would be directly across the platform for Livermore patrons with destinations north of Bay Fair. This is attained by revising the tracks so westbound trains from Livermore would use the same platform as northbound trains from Fremont. Likewise, eastbound Livermore trains and southbound Fremont trains would use the same platform. An additional central platform, Platform B, would be built east of existing Platform A and the existing northbound Fremont Track 1 would be relocated to the east. The Valley Line would approach Bay Fair from the south between the platforms. Near the station the existing northbound Fremont track would be used by eastbound Livermore trains. New Track 3 for westbound Livermore trains would be immediately to the east. The new central platform and relocated northbound Fremont Track 1, which is grade separated from the Valley Line, would be east of Track 3. Existing Platform A would be used jointly by southbound Fremont trains and eastbound Livermore trains.

Trains from Livermore would enter the station on Track 3, unload passengers at Platform B, which is also used by passengers boarding northbound Fremont trains on Track 1. The Livermore train then would cross over to Track 4, reverse direction and re-enter the station adjacent to Platform A. Livermore-bound passengers would board the train from Platform A, the same platform used by disembarking Fremont Line passengers. This layout would provide across platform transfers from Livermore to Oakland in the morning and from Oakland to Livermore in the evening. In the non-peak direction, transferring passengers would have to move to the other platform via the mezzanine.

To reach the Hayward Yard for heavy maintenance or storage, Livermore trains would proceed to the reversing section of Track 3 north of the platforms reverse direction and proceed to southbound Track 2 via the crossover immediately north of Platform A. Returning from the Hayward Yard, Valley Line trains would continue via northbound Track 1 to a point north of Platform B, switch to Track 3, reverse direction, cross over to Track 4 and proceed to Livermore.

Two reversing tracks would increase the operational flexibility and capacity of the Valley Line shuttle service. Trains could be directed to either Track 3 or Track 4 for reversing direction or temporary storage. A double crossover at each end of the station platform would further increase flexibility by allowing Fremont Line trains to use Track 3 and/or 4 in an emergency while Track and/or 2 in the station area is blocked.

An important feature of this scheme is that it permits the Valley Line to merge with the Fremont Line without crossing it at grade. Trains from Livermore arriving on Track 3 would merge with northbound Track 1 of the Fremont Line north of Platform B. Southbound trains would be switched from Track 2 to Track 4 at a point north of Platform A and routed to Livermore.

Castro Valley Station Alternates

Four Castro Valley Station sites currently are under consideration, each occupying 13 acres and accommodating 1,000 cars. If the Dublin Canyon Corridor is selected more detailed evaluations will be made and a schematic design prepared for the recommended site.

Castro Valley Station
NE Redwood Road/Site 1 (Red, Green and Blue Lines)

Site 1, in the northeast quadrant of the Redwood Road/I-580 interchange, curr is occupied by 54 housing units and seven businesses. Commercial developme

adjoins to the north and a trailer court and single-family homes bound the fourth side. Access would be from Redwood Road on the west and an extension of Forest Avenue on the north. CALTRANS 1990 traffic projections show Redwood Road north of I-580 carrying 23,000 vehicles per day, well within capacity after planned widening to six lanes. Castro Valley Boulevard is expected to carry 31,000 vehicles per day, east of Redwood Road and 40,000 vehicles per day to the west, exceeding its 35,000 vehicle capacity. A new street connecting the northeast corner of the station site with Castro Valley Boulevard would handle BART trips originating east of Redwood Road. Site 1 has the disadvantage of mixing evening peak commuter traffic with shopper traffic. A compensating advantage is that it has the largest service area of the four sites because it is farthest from Bay Fair.

Castro Valley Station
NW Redwood Road/Site 2 (Red, Green and Blue Lines)

Site 2, directly opposite Site 1 and immediately west of the commercial establishments fronting on Redwood Road, is occupied by 31 housing units and three businesses. The station parking lot would be split by Wilbeam Avenue which would be connected to Redwood Road by a new street north of the site. The section of Norbridge Avenue between Wilbeam Avenue and Redwood Road would be abandoned. The service area and accessibility characteristics of the site are similar to Site 1 except that the heavy exiting left turn into northbound Redwood Road would occur at the evening peak hour, requiring a traffic signal. Division of the parking lot by Wilbeam Avenue is another disadvantage.

Castro Valley Station
North Lake Chabot/Site 3 (Red, Green and Blue Lines)

Site 3 is on the west side of an extension of Lake Chabot Road from Castro Valley Boulevard to Norbridge Avenue and is occupied by 36 housing units and nine businesses. Access from the east would be by Norbridge Avenue, from the north by an extension of Lake Chabot Road, and from the north and west by Norbridge Avenue/Stanton Avenue and Castro Valley Boulevard. CALTRANS 1990 projections show Lake Chabot Road carrying only 17,000 vehicles per day, but Castro Valley Boulevard will carry 43,000 at Lake Chabot Road, a volume well above its capacity. The intersection of Lake Chabot Road and Castro Valley Boulevard would be congested during peak periods, but delays are likely to be shorter than at Site 1 or Site 2. The westerly location of this site station minimizes out-of-direction travel for Castro Valley patrons, but would cause many riders to avoid the transfer by going directly to Bay Fair. Planned high density housing near this site would create a potential for walk-in patronage. A pedestrianway from Strobridge Avenue south of the freeway would be desirable.

Castro Valley Station
South Lake Chabot/Site 4 (Red, Green and Blue Lines)

Site 4, on the south side of I-580, is centered on a southward extension of Lake Chabot Road from Castro Valley Boulevard to relocated Strobridge Avenue. The site is bounded by Strobridge Avenue on the west and south, Lake Chabot Road on the east, and I-580 on the north. Eighty-eight housing units would be removed.

The station site is split into two sections by the extension of Lake Chabot Road south across I-580 to a relocated Strobridge Avenue. The westerly portion of the station, which comprises about 60 per cent of the total station area, would be used primarily for long-term parking. The easterly section would be used for short-term parking, kiss-and-ride, buses and taxis. Because access to the station mezzanine and platform is from the easterly side only, long-term parkers using the westerly portion of the site would have to cross Lake Chabot Road to the station. CALTRANS 1990 traffic projections do not indicate problems on Lake Chabot Road extension, but, as previously noted, the intersection of Castro Valley Boulevard and Lake Chabot Road will be congested during peak periods, as will the partial interchange with I-580 at Strobridge Avenue.

Service and accessibility characteristics are similar to Site 3 except that with the planned high density residential development on the north side of the freeway, 400 feet would be added to walking distances. Site 4 would cause major disruption to the stable single-family residential neighborhood south of the freeway.

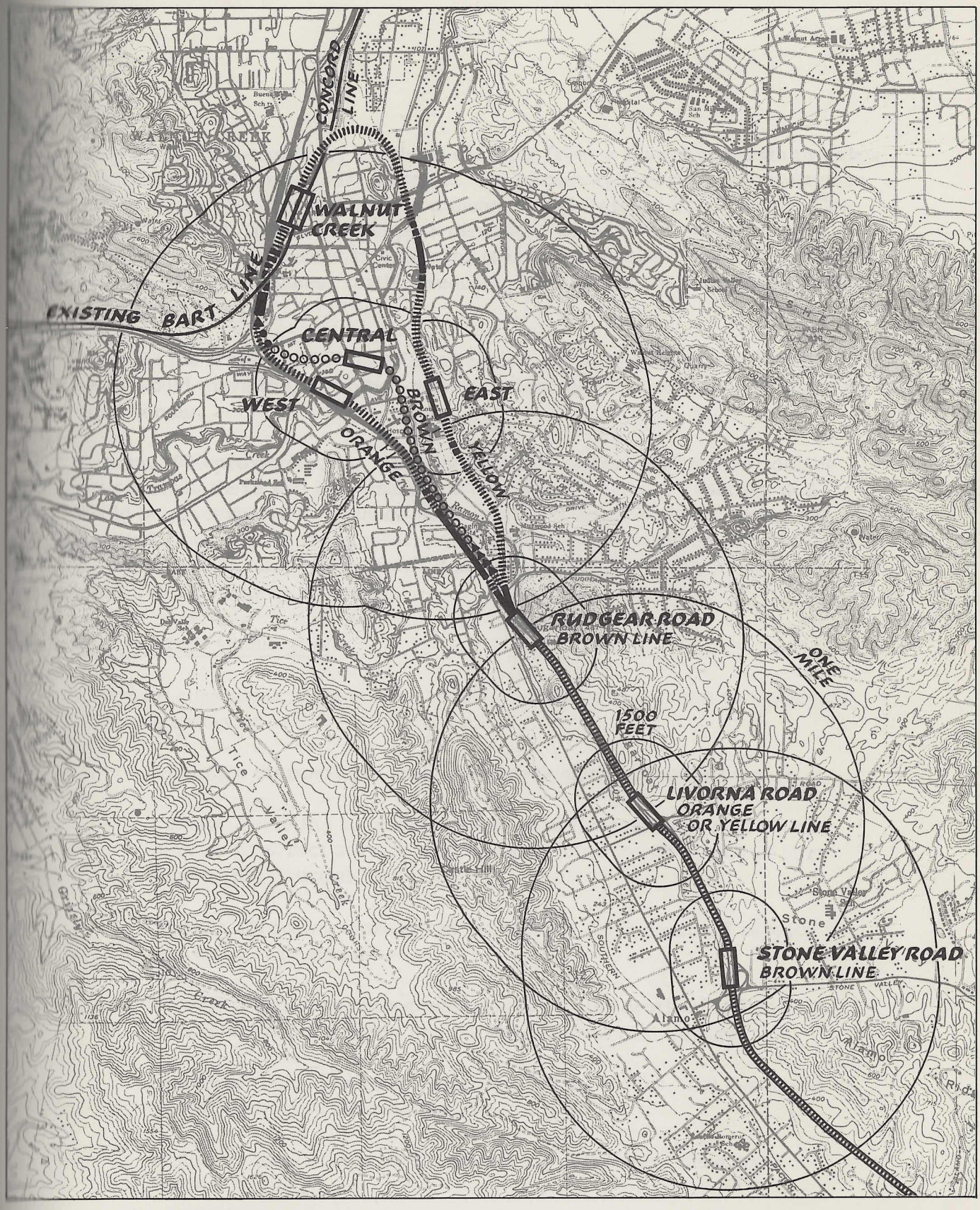
SAN RAMON VALLEY CORRIDOR

Route Description

Three alternative BART lines connecting Walnut Creek and Dublin have been studied. The Yellow Line connects to the Walnut Creek Station from the northeast and follows the Southern Pacific railroad tracks south to Rudgear Road. The Brown Line runs south from the existing Walnut Creek Station through downtown in a bored tunnel before entering the I-680 median, and the Orange Line heads south from the existing station along the freeway west of downtown before entering the freeway median. All lines would be in a widened I-680 freeway median to Danville and in the S.P. right of way between Danville and Station A in Dublin.

Impact of Operations Policy

An operations policy that does not permit connecting an extension directly to the main line would inconvenience transferring passengers, but careful sched-



AERIAL STRUCTURE
EMBANKMENT
AT GRADE
DEPRESSED
CUT AND COVER SUBWAY
BORED TUNNEL
AT GRADE OR AERIAL

N

0 2000'

Livermore-Pleasanton
BART Extension
Walnut Creek Alternates

Orange, Brown, Yellow Lines

uling could minimize delay for those changing from a Livermore train to either a Daly City or a Concord-bound train. Peak headways average six minutes on the Concord Line and would be six minutes on the Valley Line, so every Concord Line train, at least in the peak direction, could be scheduled to meet a Livermore train. Patrons transferring to Concord-bound trains would wait an average of three minutes, further reducing the already low patronage potential in that direction.

To avoid the transfer at Walnut Creek Station, many south Walnut Creek residents would drive to the existing station rather than to a new station closer to their homes.

Current 1980 projections for the existing BART system indicate that during peak periods there will be standees on the Concord Line, a condition that would be exacerbated by connection of a Valley Line at Walnut Creek. All Concord Line patrons living west of the transfer point would be affected, and by the time peak hour trains reach Rockridge Station there would be twice as many riders standing as sitting.

Walnut Creek Connection

Alternate connection designs have been developed in an attempt to satisfy the following criteria:

Minimize disruption of train operations on the Concord Line.

Provide flexibility to permit operation of the extension as a shuttle service or direct service without sacrificing the efficiency of service on the Concord Line.

Provide adequate trackage and crossovers for turnaround service and temporary storage.

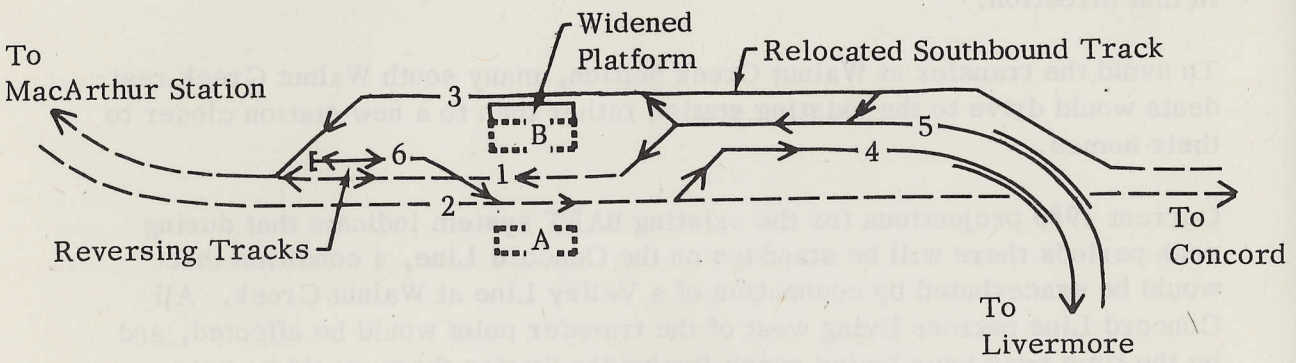
Provide a direct service connection for trains destined to the Hayward and Concord Yards for maintenance and car storage.

Minimize disruption to the existing station, tracks, and developed areas adjacent to the existing line.

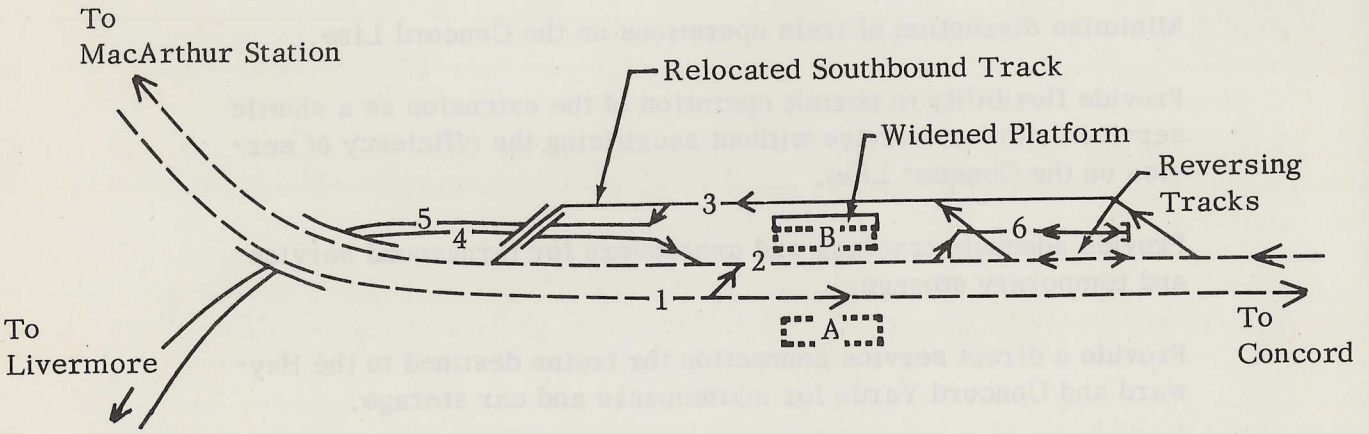
Minimize the distance that transferring passengers must walk between trains.

WALNUT CREEK STATION
CONNECTION ALTERNATIVES

SCHEME 1



SCHEME 2



New Track
Existing Track
Platform

The Yellow Line would connect to the existing BART Line Scheme 1 as shown in the diagram, crossing over the northbound Concord Line track and descending to the grade of the tracks at the existing Walnut Creek Station. It would be necessary to remove the existing southbound Concord Line track from North Main Street to Ygnacio Valley Road, and reconstruct it 36 feet west. Platform B would be widened to 25 feet to function as a central platform. The northbound track from Livermore, Track 5, would join Track 2 north of the station. A tail track, Track 6, just south of Platform B, and the adjacent section of Track 2 would be used for reversing trains and temporary train storage. Platform A and Track 1 would be shared by Concord and Livermore-bound trains. Trains would arrive from Livermore on Track 5, proceed to Track 2 and unload at widened Platform B. Passengers heading toward Oakland would board the Daly City train on Track 3 from the same platform. Passengers continuing toward Concord would descend to the mezzanine level, ascend to Platform A, and board on Track 1. After unloading, the Livermore trains would reverse direction on Track 2 immediately south of Platform B, cross over to Track 1 and re-enter the station at Platform A. After loading Livermore-bound passengers the train would leave the station heading north.

In the reverse direction riders on a Daly City to Concord train desiring to transfer to the Valley Line would arrive and depart at Platform A. Passengers on a Concord to Daly City train desiring to transfer to the Valley Line would have to change from Platform B to Platform A.

Valley Line trains destined to the Hayward Yard for service would cross over from Track 5 to Track 3 north of Platform B and head toward Oakland. Trains returning from the Hayward Yard would arrive on Track 1, switch to Track 4 north of Platform A, and proceed to Livermore. In addition, connections to and from the Concord Yard would be provided to allow use of the Concord Yard for train storage.

This scheme has the disadvantage of requiring Concord and Livermore-bound trains to share the same track. When trains are operated at six minute headways on each line, headways would be three minutes on Track 1. If this proves unacceptable, it would be necessary to widen Platform A and construct a fourth track through the station to the east for northbound trains on the Concord Line, reserving Track 1 for southbound Livermore trains. To do this without coming very close to the Fidelity Savings Building or even demolishing it would require station reconstruction to the west of the present location.

The Brown and Orange Lines would use Scheme 2 in which the Valley Line approaching from the south, would cross under both tracks of the Concord Line

and ascend to the grade of the existing tracks. Track 2, the existing southbound Concord Line, would connect to Track 4 from Livermore to serve northbound trains. A new track, Track 3, would be constructed 36 feet to the west of Track 2 running from just north of Trinity Avenue to North Main Street. This new track, which would cross over the Valley Line just south of Lacassie Avenue, would be shared by both Concord to Daly City trains and Walnut Creek to Livermore trains. Platform B would be widened to 25 feet as a central platform. A tail track, Track 6, just north of Platform B, and the adjacent section of Track 2 would be used for reversing trains and temporary storage. Trains from Livermore would approach the existing Walnut Creek Station on Track 4, merge with Track 2, and unload at Platform B which also would be used by passengers boarding Daly City trains on Track 3. After unloading, trains from Livermore would continue north to Track 6, reverse direction, cross over to Track 3 and load southbound Valley Line passengers at Platform B. Valley Line passengers heading toward Oakland and westbound Concord Line passengers heading toward Livermore would transfer across Platform B. However, eastbound Concord Line passengers transferring to the Valley Line and Livermore passengers going toward Concord would have to change platforms.

A Livermore train bound to the Concord Yard would cross over from Track 2 to Track 1 north of Platform B. Returning from the Concord Yard, trains would enter the station on Track 3, switch to Track 5 south of Platform B, and continue to Livermore. Livermore trains headed for the Hayward Yard would approach Walnut Creek Station on Track 4, reverse direction on Track 2 north of Platform B, cross over to Track 3 and proceed to Hayward on Track 4. In the reverse direction a train would approach Walnut Creek Station on Track 1, cross over to Track 2 south of Platform B, reverse direction on Track 2 north of Platform B, cross over to Track 3 and return to Livermore on Track 5.

As in Scheme 1, Scheme 2 would require two trains to share one track if major reconstruction is to be avoided.

Walnut Creek Station Alternatives

Three sites were studied in an effort to locate a second Walnut Creek station within walking distance of as many potential jobs as possible, while minimizing disruption by the BART line.

The Yellow Line would use Scheme 1 to connect with the Concord Line at Walnut Creek Station. Heading northeast from the station, the Valley line would

cross over the existing BART aerial structure and curve eastward on a 45 mile per hour curve before heading southward on aerial structure in the median of widened Civic Drive. Relocation of the southbound lanes of North California Boulevard 50 feet to the west and reconstruction of the intersections with North Main Street and with Pringle Avenue would be necessary. North of Ygnacio Valley Boulevard the Yellow Line would cross over the northbound lanes of Civic Drive to the S.P. right-of-way. The S.P. track would be relocated 20 feet to the east so that BART could occupy the westerly 40 feet of the right-of-way. After crossing Ygnacio Valley Boulevard, BART would descend to the same grade as the railroad south of the Walnut Creek channel. From Lincoln Avenue southward to Walnut Creek East Station E at Newell Avenue, the Yellow Line would remain on aerial structure. South of Mt. Diablo Boulevard a high retaining wall would border the S.P. tracks, and between Capwell Street and Newell Avenue the existing 50 foot right-of-way would have to be widened.

Walnut Creek East Station E
Newell/Broadway Site/SPRR (Yellow Line)

This four acre station site on the south side of Newell Avenue is bisected by the Southern Pacific tracks. The west portion currently is occupied by a nursery and the east half is employee parking for businesses in south Walnut Creek. The schematic plan proposes that the western half be used for long-term parking and the eastern half for short-term parking, kiss-and-ride, and bus and taxi drop-off areas. To meet the anticipated need for 800 long-term parking spaces, four levels would be built on the west portion. The east side of the station site would have 150 short-term parking spaces at ground level. To accommodate this station, it would be necessary to relocate the S.P. tracks to the east. It is anticipated that the S.P. tracks as they cross Newell Avenue would remain at grade. BART would be on aerial structure directly over the intersection of South Broadway and Newell Avenue making special design treatment necessary.

From the east, motorists could reach the station via San Miguel Drive and Newell Avenue, both of which are two-lane residential streets carrying moderate traffic. The northeast and north approach would be via Walker Avenue, Sierra Drive, Ellsworth Place, and South Broadway. All except South Broadway are two-lane residential streets and some now are congested during peak periods. CALTRANS 1990 projections show Walker Avenue and San Miguel Drive carrying light volumes, so only minor congestion would be expected for vehicles arriving from the east. However, Newell Avenue, Main Street and Mount Diablo Boulevard are anticipated to carry heavy traffic. Newell Avenue, the primary access from the west, is expected to carry 50,000 cars per day west of California Boulevard, greatly in excess of its capacity. Main Street, where a daily volume of 30,000 is projected

between Newell Avenue and Mount Diablo Boulevard, will be congested. Vehicles arriving from the south would depend entirely on Main Street which is expected to have only moderate congestion south of Newell by 1990.

Circulation on the station site would be impeded by the presence of the S.P. tracks at grade through the middle of the station site. A grade-separated pedestrian crossing should be provided. Vehicular access from the east side to the west side of the station site would not be possible without using Newell Avenue unless Southern Pacific were to allow an at grade crossing of the tracks.

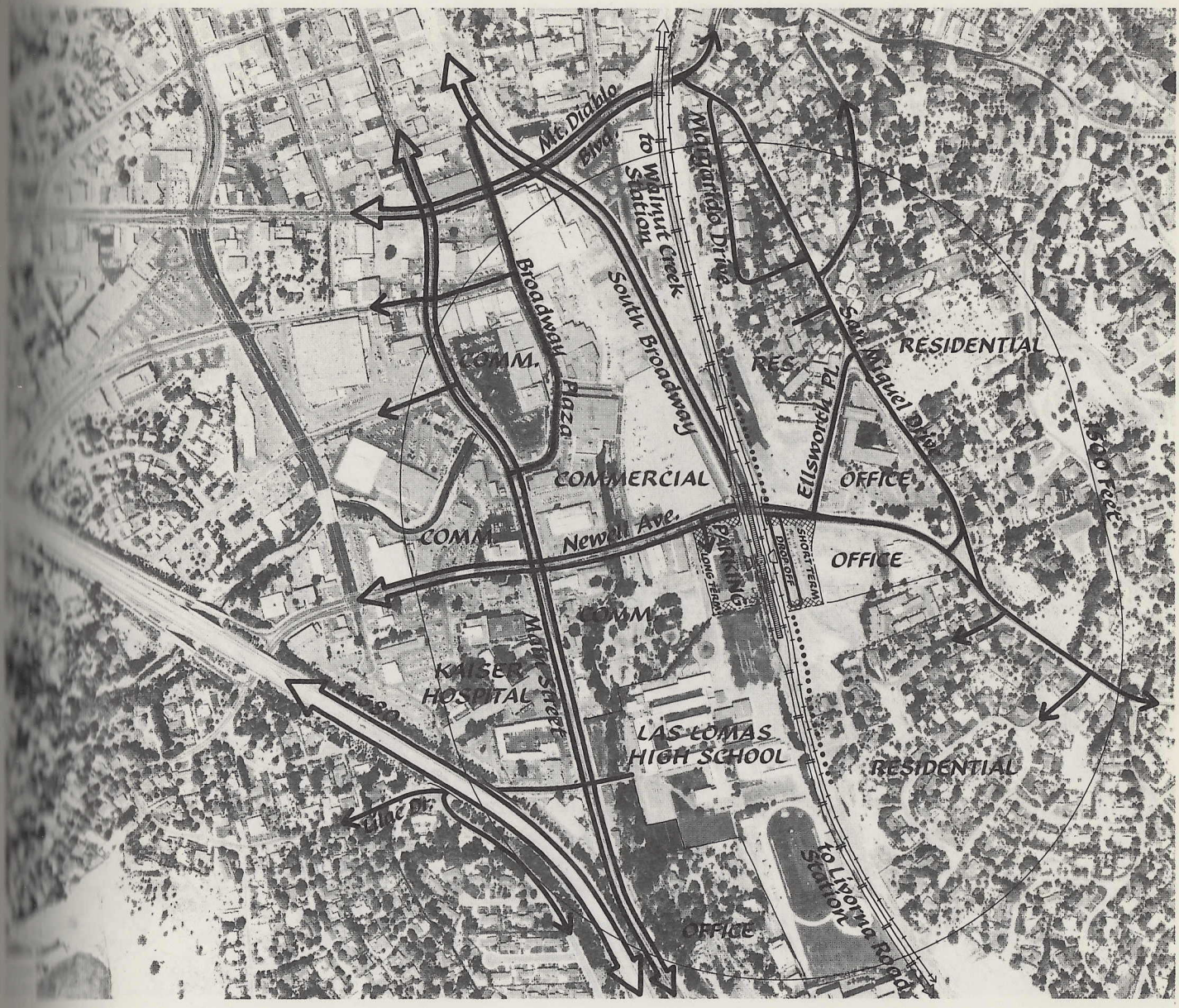
This station would be convenient for the patrons of Walnut Creek east of the Southern Pacific tracks and south of Newell Avenue. Areas north and west would not be as well served.

The station is well within the 1,500 foot walking range of Kaiser Medical Center, several small medical offices, Broadway Plaza Shopping Center area, Security National Bank building, and an expanding apartment area on the hill to the east. Shopper and out-patient travel benefits are excellent but, because this station would be on the edge of the central area, it has the least potential for large employment increases nearby. The 1990 high projection anticipates less than 10,000 employees within walking distance.

South of Walnut Creek East Station, the Yellow Line would return to the same grade as the railroad adjoining Las Lomas High School. South of Muirwood Drive aerial structure would carry BART over San Ramon Creek and the railroad. After crossing the northbound lanes of I-680, BART would remain in the median, either on aerial structure or at grade, to the Alamo Station at Livorna Road.

The Brown Line would use Scheme 2 to connect to the Concord Line at Walnut Creek Station and would proceed to Walnut Creek Central Station by bored tunnel. To accomplish this, the southbound lanes of North California Boulevard between North Main Street and Pringle Avenue would be relocated to the west and the intersections with North Main Street and Pringle Avenue reconstructed. Oakland Boulevard between Ygnacio Valley Road and Trinity Avenue would be relocated to the east side of the existing BART aerial structure taking 50 feet from adjoining properties. The intersections of Oakland Boulevard with Ygnacio Valley Road and Trinity Avenue would be redesigned.

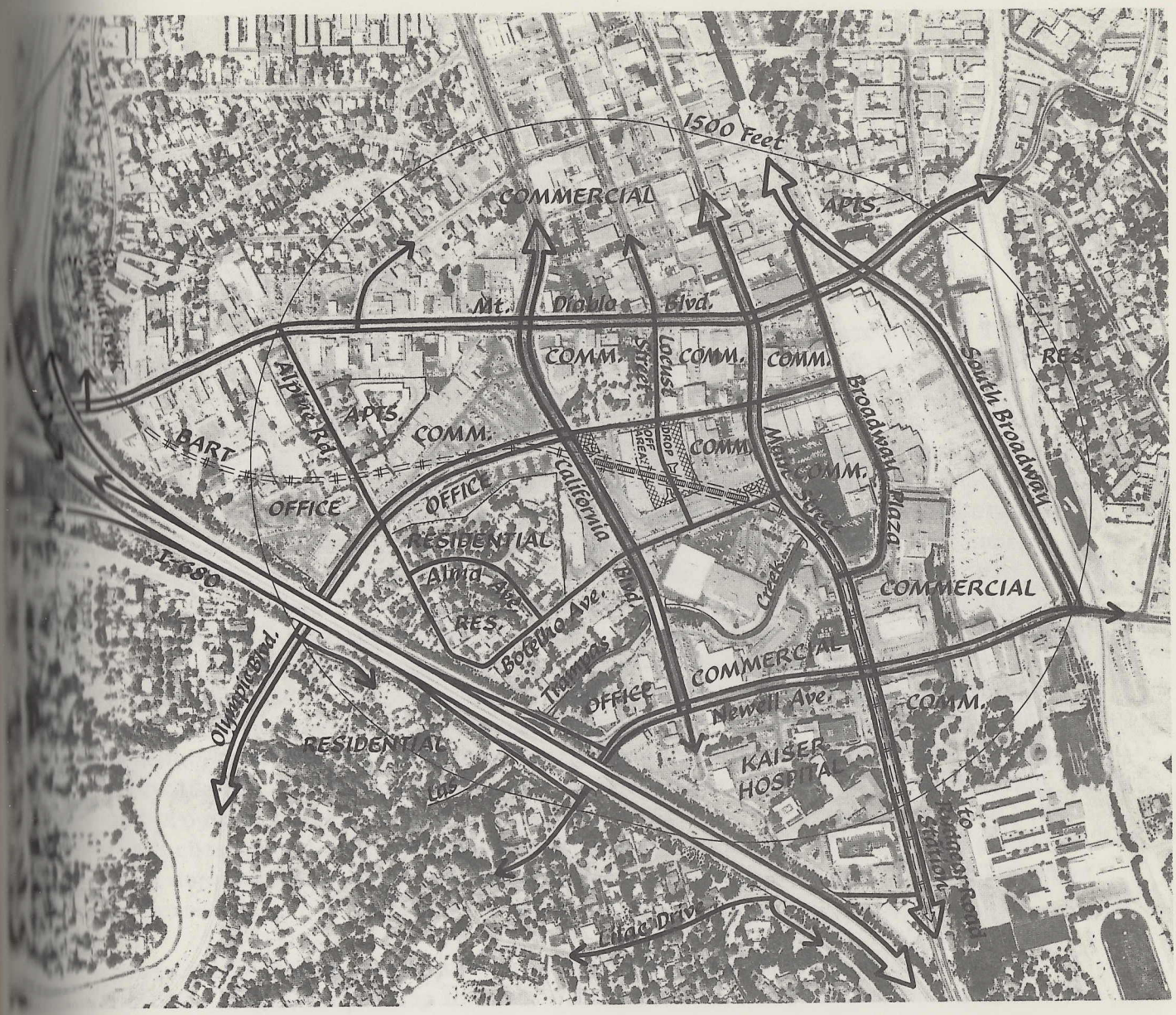
The Brown Line would pass under Trinity Avenue and the existing BART Concord Line, turn southward in open cut between Oakland Boulevard and I-680, continue to 1,000 feet north of the Oakland Boulevard/Mount Diablo Boulevard intersection where it would curve easterly on a 50 mph curve, descend into a cut-and-cover



Schematic Site Plan

Walnut Creek East Station E
Newell/Broadway/SPRR
Yellow Line

Livermore-Pleasanton BART Extension



Schematic Site Plan

Walnut Creek Central Station C
Olympic/California/Subway
Brown Line

Livermore-Pleasanton BART Extension

N

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subway, cross under Oakland Boulevard, enter a bored tunnel at Mount Diablo Boulevard, and proceed to Walnut Creek Central Station.

Walnut Creek Central Station C
Olympic/California/Subway Site (Brown Line)

This site is in the block currently occupied by Simon's Hardware store. The site is served on four sides by major streets: Olympic Boulevard to the north, Main Street to the east, Botelho Drive to the south, and California Boulevard to the west. Because of its location near the center of downtown long-term parking would be undesirable and the cost excessive. Traffic congestion around the station site would be disruptive to business activities and the amount of potential employment within walking distance would be reduced. An area 200 by 300 feet, centered on an extension of Locust Street, would be sufficient to accommodate 100 short-term parking spaces and kiss-and-ride, bus, and taxi service. If the entire Simon's parcel were acquired, the balance could be leased or sold for office development. Primary access would be on Locust Street which would be extended from its present terminus at Olympic Boulevard south to Botelho Drive. Subway entrances would be located at the California Boulevard/Olympic Boulevard and Botelho Drive/South Main Street intersections and on Locust Street. The station is within easy walking distance of the major portion of downtown Walnut Creek, including the Kaiser Medical Center, Broadway Plaza, and most of the existing and proposed office buildings in central and south Walnut Creek. This site has the highest potential for employment increases and 20,000 of the 35,000 possible total downtown jobs are projected to be within walking distance. Only 100 persons are expected to live within the 1,500 foot area.

Because it would be undesirable to provide long-term parking at this site, the need for long-term parking in south Walnut Creek for outbound commuters would have to be met by constructing a station near Rudgear Road.

The Brown Line would continue in bored tunnel from Central Walnut Creek Station, turn southward on a 40 mph curve, cross under Las Trampas Creek, and continue southward under South Main Street to I-680. At the freeway, the line would turn southeastward, cross under the northbound lanes and enter the median, ascending to grade.

South Walnut Creek Station
Rudgear Road Site (Brown Line)

This 12 acre site, which would be used only in conjunction with the Brown Line subway alternative through Walnut Creek, is between Danville Boulevard and

I-680, 800 feet south of Rudgear Road. It is occupied by five single family homes. The station would be in the median of I-680, with the platform at freeway grade and the mezzanine one level below. A pedestrian subway under the southbound freeway lanes would connect a 1,000 space parking lot to the station. Vehicular access to the parking lot would be from Danville Boulevard. It would be necessary to bridge portions of San Ramon Creek, which runs through the station site, or to relocate it adjoining Danville Boulevard and provide access bridges.

This station would serve most of South Walnut Creek which is projected to have a 1990 population of 32,400. There is no employment potential near this commuter station.

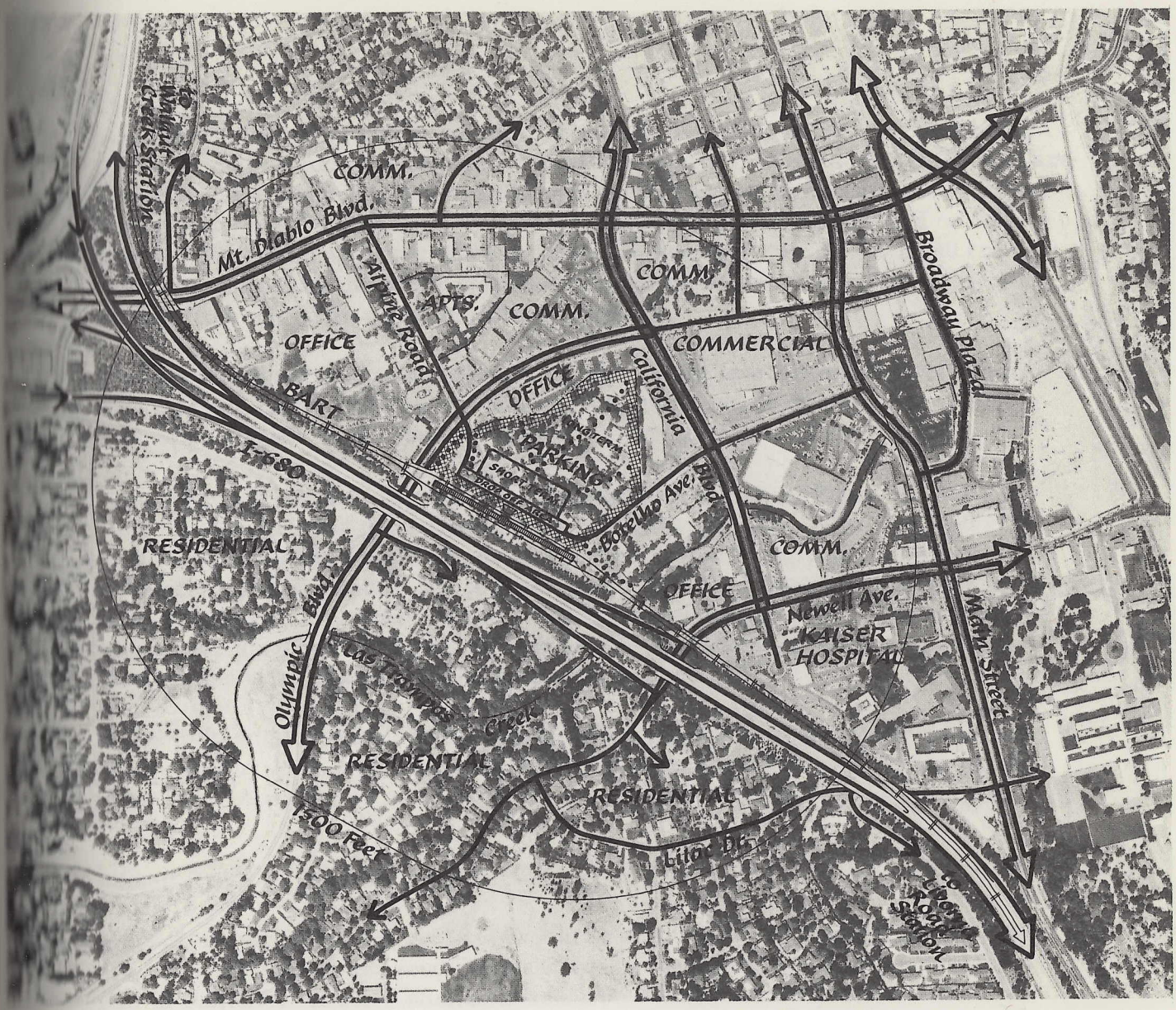
South of the South Walnut Creek Station the Brown Line is identical to the other line alternatives except that the Alamo Station is at Stone Valley Road.

The Orange Line would skirt the western edge of the downtown, following the east side of I-680 to a park-and-ride station south of Olympic Boulevard.

This Line also would use Scheme 2 to connect the Livermore Line to the Concord Line at the existing Walnut Creek Station. Street relocations and intersection modifications would be similar to the Brown Line alternative. From Walnut Creek Station, the Orange Line would cross over Ygnacio Valley Road, descend to pass under Trinity Avenue between Oakland Boulevard and I-680, and proceed southward in open cut at freeway grade along the east side of the freeway. The line would turn on a 50 mph curve, climb to aerial structure, cross over Mount Diablo Boulevard and Olympic Boulevard, and enter Walnut Creek West Station W.

Walnut Creek West Station W
Olympic/Alpine/I-680 Site (Orange Line)

This 11 acre station site, bounded by Olympic Boulevard, California Boulevard and Botelho Drive and I-680, currently is occupied by 32 single family homes, most of which are exposed to severe freeway noise. Access from the west would be on Newell Avenue or Olympic Boulevard and patrons from the north would use Alpine Road or California Boulevard. Access from the south would be via South Main Street and Botelho Drive. Mount Diablo Boulevard or Newell Avenue would carry traffic from the east. Projected traffic volumes on California Boulevard, North Main Street and Broadway Plaza combined are 60,000 vehicles per day, while total capacity is 80,000 to 90,000. Because of very high projected volumes on Mount Diablo Boulevard and on Newell Avenue west of Main Street, traffic arriving from the east would experience congestion on either route. Access from the south would be relatively poor if no new interchange is built. All vehicles now arrive on either



Schematic Site Plan

Walnut Creek West Station W
Olympic / Alpine / I-680
Orange Line

Livermore-Pleasanton BART Extension

Danville Boulevard or I-680 and enter Walnut Creek on South Main Street where moderate congestion is anticipated. Traffic volumes projected by CALTRANS are based on the assumption that an additional I-680 freeway interchange will be constructed at Newell Avenue and California Boulevard to relieve the load on South Main Street. With an interchange at Newell Avenue for northbound I-680 traffic, vehicles destined to the BART station could choose between two interchanges and access from the south could be termed adequate.

The site would accommodate all parking on a single level with short-term parking, kiss-and-ride, and bus and taxi service on the westerly portion and 800 long-term spaces on the easterly portion, more distant from the platform.

This station is beyond easy walking distance from Broadway Plaza and offices north of Mount Diablo Boulevard and east of California Boulevard. However, it is close to recently built offices along Olympic Boulevard and California Boulevard, and is within 1,500 feet of Kaiser Medical Center. Pedestrian access from residential areas west of the I-680 barrier would be poor. The station would have the disadvantage of forcing east Walnut Creek patrons to travel through the heart of downtown to reach the station.

A five-fold employment increase to 15,000 is projected within walking distance of this site by 1990, continuing the office development trend for this sector of downtown. Apartments can be expected to replace older family units west of I-680.

Walnut Creek to Danville Alternatives

Each of the three San Ramon lines would enter the I-680 freeway right of way at a different location in south Walnut Creek, but would exit at the same location in Danville. Earlier studies considered the S.P. route for this BART segment, but the visual and noise impact of aerial structure on nearby homes would be severe and disruption would occur where stretches of 50 foot right of way would be widened by 20 feet, so this alternative was abandoned.

The section of I-680 between Rudgear Road in Walnut Creek and Sycamore Valley Road in Danville initially was designed with four lanes and a 46 foot median with provision for narrowing the median to add two lanes. CALTRANS now is constructing an additional lane on the outside of each roadway which allows the future addition of two lanes in the median.

Four alternatives for accommodating BART along I-680 have been studied, three using the freeway median and one along the west side of the freeway: Alternative 1,

BART on aerial structure in the 46 foot median of the existing six-lane freeway; Alternative 2, BART on aerial structure in the 30 foot median of a reconstructed eight-lane freeway; Alternative 3, BART at grade in the 80 foot median of a reconstructed eight-lane freeway; Alternative 4, BART primarily at grade along the west side of the southbound lanes of either the existing six-lane freeway or the existing freeway widened in the median to provide eight lanes. Aerial stations would require localized widening to a maximum of 12 feet on the outside of each roadway. An escalator would connect the station platform with the mezzanine one level below the freeway. Alternatively, the freeway median could be widened to 80 feet in the vicinity of stations to permit the platform to be at grade. This would result in a rollercoaster alignment with the BART at grade at the stations and on aerial structure between stations. Advantages would be easier station construction, less vertical distance between the mezzanine and the platform, and greater horizontal clearance to the adjacent roadways. Disadvantages include the widening disruption and the uneven vertical alignment.

Alternative 1: No freeway widening would minimize acquisition and disruption to adjacent properties, which is especially significant if, because of BART, it becomes unnecessary to widen the freeway to eight lanes. BART's reimbursement to CALTRANS would be $2 million less than for Alternative 2.

Alternative 2: This alternative assumes that the freeway will be widened to eight lanes initially, possibly in conjunction with construction of the BART line. Eight feet of additional right of way would be acquired on the east side of the existing freeway. For an aerial station, the freeway would be widened by 24 feet on the east side. At grade stations could be provided by widening the median from 46 to 80 feet by using additional right-of-way on one or both sides. The advantages of Alternative 2 are that an eight-lane freeway and a BART line can be constructed with minimum right of way acquisition and that there will be no disruption to abutting properties on the west side of the freeway, except possibly at stations. Disadvantages include higher cost ($10 million more than Alternative 3), less horizontal clearance to BART columns between stations than in Alternative 1, and the rollercoaster vertical alignment for BART if stations are at grade.

Alternative 3: BART would be at grade in the median, requiring freeway reconstruction to widen the median to 80 feet (40 feet for BART and 20 feet clearance on either side). The cost would be less than for the other alternatives and the difference for widening to six lanes or eight lanes would be minor because one side of the freeway would have to be reconstructed in either case. Keeping BART at grade would minimize the distance between the mezzanine and the platform.

Disruption during construction and alteration of the landscape would be similar to that caused by reconstruction of State Route 24 to accommodate the Concord Line between Orinda and Walnut Creek. For evaluation purposes this alternative is considered the basic alignment for the San Ramon Corridor lines.

Alternative 4: BART would border the west side of the freeway, requiring a wider combined BART/freeway right-of-way than the other alternatives. Although some of the BART line could be at grade, it would have to cross over freeway interchanges on high aerial structures that would be visually obtrusive. Most of the residences along the west bank of San Ramon Creek would be removed and there would be extensive relocation of the creek channel.

Alamo Station
Livorna Road Site (Yellow and Orange Lines)

On the Yellow and Orange Lines, the Alamo Station would be in the northeast quadrant of the Livorna Road/I-680 interchange. The 12 acre site on currently vacant land would accommodate 1,000 cars. The station platform would be in the freeway median immediately north of Livorna Road, connected to the parking area by a bridge across the northbound freeway lanes and entrance ramp. Access would be only from Livorna Road, which is expected to carry about 13,000 vehicles a day by 1990 and could be widened to four lanes. The only traffic problem is that access is concentrated at one point immediately adjacent to a diamond interchange.

This station would have the largest projected 1990 tributary population - 47,400 persons. There would be no employment within walking distance.

Alamo Station
Stone Valley Road Site (Brown Line)

This station, associated only with the Brown Line subway alternative in Walnut Creek, would be at the Stone Valley Road/I-680 interchange. Two alternative locations in the northeast and southwest quadrants of the interchange have been examined. Site 1, the northeast quadrant, occupies 8 acres (700 parking spaces) including the Doris Eaton School and a portion of the horse stables property. Access would be by a street from Stone Valley Road on the approximate alignment of the existing dirt road. Access from the parking area to the station platform in the median of I-680 would be by a pedestrianway either over or under the northbound freeway lanes. The minimum walk from the parking lot to the platform would be 500-600 feet.

Site 2, the southwest quadrant of the Stone Valley Road/I-680 interchange, would occupy 8 acres (700 parking spaces) of a vacant L-shaped parcel allowing access from both Stone Valley Road and Danville Boulevard. Because the station platform would be in the median of I-680, a separate pedestrianway must cross over or under the southbound freeway lanes. The curvature of the freeway dictates that the centerline of the station platform be slightly north of Stone Valley Road, making walking distance from the platform to the parking area 200 feet longer than at Site 1.

Site 2 is superior to Site 1 from the standpoints of access and parking, and is closer to the developed part of Alamo than a site east of the freeway. The 15,000 cars per day projected for Stone Valley Road in 1990 should not congest a four lane arterial. Danville Boulevard through Alamo is projected to carry between 20,000 and 23,000 vehicles per day, causing moderate congestion during peak periods. Neither site would have much walk-in patronage. The 1990 projected tributary population is 35,400 and no nearby employment is expected.

All San Ramon Valley Corridor lines would leave the I-680 freeway right-of-way 1,200 feet north of the Diablo Road Interchange proceed southward along the east side of the freeway, pass over the Diablo Street Interchange and San Ramon Creek, and enter the S.P. right of way 1,000 feet north of Sycamore Valley Road.

Danville Station
Sycamore Valley Road Site (Yellow, Brown, and Orange Lines)

This aerial station, included on all San Ramon Valley lines, would be between Laurel Drive and Sycamore Valley Road, just east of the S.P. tracks. The site, sufficient for 700 parking spaces, currently is occupied by 23 single family homes. Access would be provided by Laurel Drive which goes under I-680, and Sycamore Valley Road which interchanges with the freeway. Brookside Drive, east of the station, would serve as the connector between Laurel Drive and Sycamore Valley Road. Both Laurel Drive and Brookside Drive are two lane local streets. Sycamore Valley Road is a major two-lane arterial at present, and is slated for expansion to four lanes. Projections for 1990 show Sycamore Valley Road carrying 12,000 vehicles per day, approximately half the capacity of the street.

No expansion of the highway commercial uses on Sycamore Valley Road is expected. This commuter station is projected to have a 1990 tributary population of 36,100.

Danville to Dublin Alternatives

The BART alignment would follow the Southern Pacific right-of-way between Sycamore Valley Road in Danville and Station A in Dublin on the east side of the track north of Crow Canyon Road, and the west side south of Crow Canyon Road. Through industrial zoned land BART would be on aerial structure to allow S.P. to offer potential shippers rail service on either side of the BART line. The remainder of the line would be at grade with short sections of aerial structure at street crossings. Alternatively, streets could overpass the BART line at grade, omitting some aerial structures through residential areas. The line could be partially depressed about ten feet below grade increasing the cost by $2.5 million per mile. Right of way restriction could require retaining walls for the depressed section.

San Ramon Station
Crow Canyon Road Site (Yellow, Brown and Orange Lines)

This aerial station would occupy 10 acres (900 parking spaces) bounded by Crow Canyon Road, the S.P. tracks, and a new road connecting Crow Canyon Road with Norris Canyon Road. The site currently is vacant. Primary access would be via Crow Canyon Road from its I-680 interchange and Norris Canyon Road. Crow Canyon Road is planned to be the only street crossing the S.P. tracks within two miles of the station. The County general plan shows a new north-south street 1,000 feet west of the Southern Pacific tracks connecting the future extension of Norris Canyon Road with Crow Canyon Road and creating a third main route to the site. To provide better access for the areas northeast of this station, Norris Canyon Road should be extended across the S. P. tracks to the future extension of Alcosta Boulevard.

Projections show from 28,000 to 36,000 vehicles per day on Crow Canyon Road in 1990 and about 5,000 vehicles per day on the other two roads serving this station. Alcosta Boulevard would carry fewer than 4,000 vehicles per day If the street extensions proposed are built, there will be sufficient capacity to handle the projected volumes. This station has a small projected 1990 tributary population of 14,900, and 2,000 projected employees within walking distance.

Dublin Station A
Kimball/Village Parkway Site (Yellow, Brown and Orange Lines)

This station was relocated north of the site shown in the Preliminary Alternatives report to equalize station spacing in the San Ramon Corridor. The best of several

sites investigated is a vacant 10 acre parcel (accommodating 900 parking spaces) immediately south of the Contra Costa/Alameda County line at Kimball Avenue between Village Parkway and the Alamo Canal. Access to this station would be by Village Parkway and an eastward extension of Kimball Avenue both connecting to Alcosta Boulevard which in turn connects to I-680.

Traffic projections show only moderate 1990 volumes on Village Parkway and on Alcosta Boulevard east of Kimball Avenue. The projected volume of 20,000 vehicles on Alcosta Boulevard west of Kimball Avenue is below the traffic capacity of this street. Therefore congestion would occur only at Alcosta Boulevard and the I-680 diamond ramps. The Alamo Canal would run between the parking area and the BART line, requiring a bridge or deck for access to the station platform.

A 1990 population of 23,500 is projected to live within one mile of this station. Eastman Kodak and the Alcosta Shopping Center are expected to be the only job locations within walking distance.

VALLEY STATIONS

Because rail transit service and its associated desirable impacts exist only at stations, the best Valley line is the one that links the best set of stations with minimum disruption. Therefore, stations are evaluated independently of lines. This report analyses potential Valley stations in greater detail than corridor stations because there are fewer alternative station sites within the corridors, and because detailed station studies in a corridor are unnecessary until a corridor selection has been made.

The Preliminary Alternatives report evaluated 14 Valley stations. Subsequent studies determined that the importance of a station at Stoneridge Shopping Center for San Ramon Corridor lines justified dropping Dublin Station B and adding Station Q east of I-680 opposite the shopping center site. Station E on Stoneridge Drive west of Hopyard Road was too close to D, and was rejected once the feasibility of Station D at Stoneridge Shopping Center was determined.

Access and development potential at Station G, east of Santa Rita Road was inferior to Station F located half a mile to the west. Station H was eliminated because it would have been far off center in its intended service area and there was little potential for BART-oriented surrounding development. Station I in downtown Pleasanton was rejected in favor of Station J for reasons described later in this section.

No further studies were made of Station P at the "new community" site north of Livermore. Station P could be on an extension of all lines under consideration, but probably would not be built as part of an initial BART extension to the Valley, so no decision is needed now. The final report will comment on the need for Station P as indicated by RTTPP Task III patronage projections and approved or proposed plans for the surrounding area.

STATION DESCRIPTIONS

The following text accompanies the schematic designs for the eight Valley stations studied.

Pleasanton Station Q
Stoneridge/I-680 Site (Orange Line)

The 9 acre station site (650 parking spaces) is bounded on the west by the Alamo Canal, on the north and east by the extension of Johnson Industrial

Drive. The south boundary is 700 feet north of Stoneridge Drive, a planned major four-lane divided arterial. CALTRANS currently is studying the possibility of providing a partial cloverleaf interchange at Stoneridge Drive and I-680 with two-phase signals at each ramp intersection. One signal would control the southbound exit ramp, and the other would control the northbound exit ramp.

Access to this site would be provided primarily from an extension of Johnson Industrial Drive. Because the regional shopping center and the transit station would be separated by the freeway and most transit patrons would arrive from the east or south, there would be less interference between shopping center and transit patrons than at Station D west of the freeway.

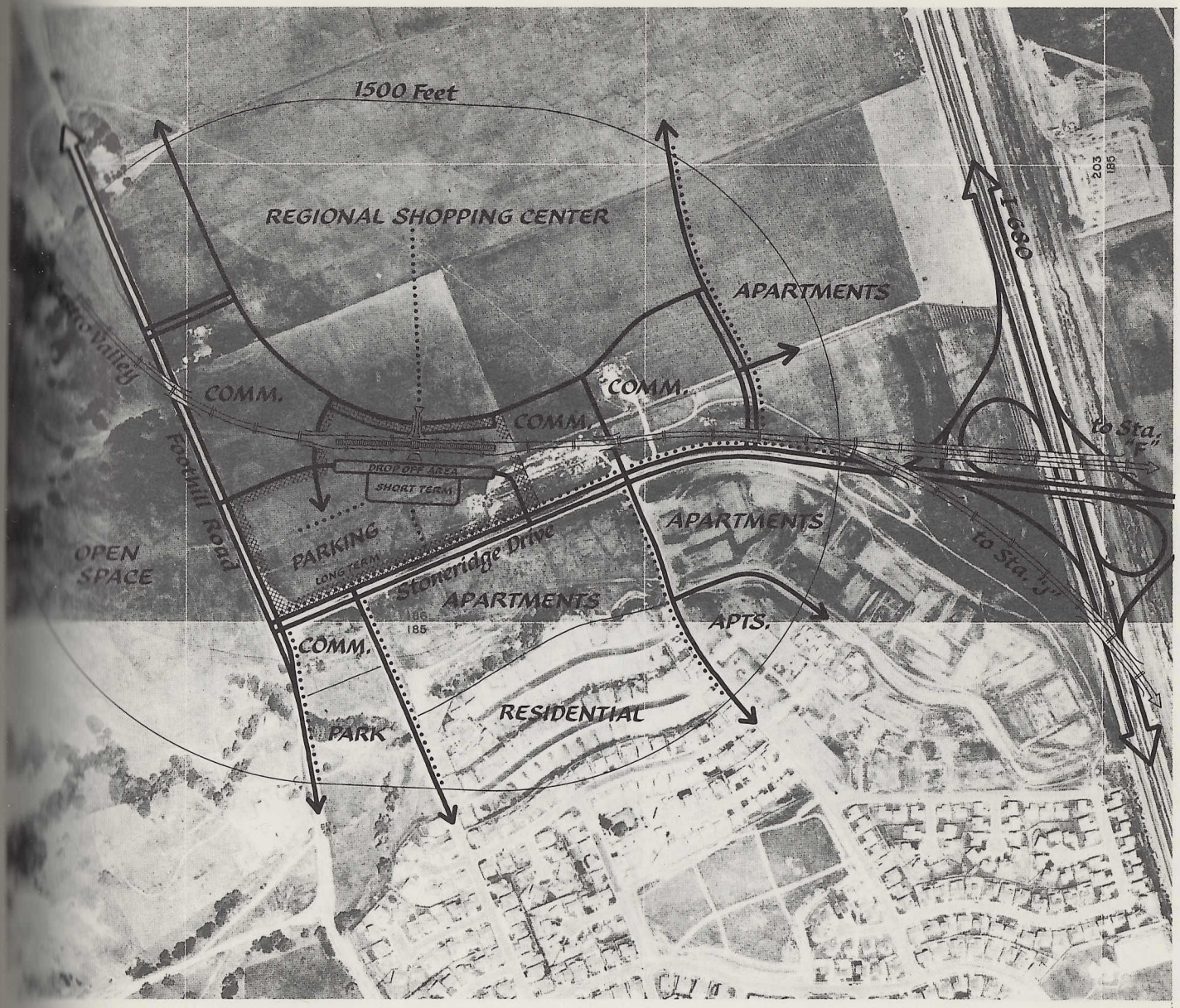
Stoneridge Drive and Las Positas Boulevard, each crossing the freeway with a capacity of 35,000 vehicles per day, should accommodate 1990 traffic. The only congested thoroughfare that would interfere with the transit station is Hopyard Road which is expected to carry 41,000 vehicles south of Las Positas Boulevard. No nearby parallel routes are available to divert the overload. The CALTRANS network assumes Stoneridge Drive to extend from Foothill Road to Santa Rita Road with the portion between Hopyard and Santa Rita Road carrying 20,000 vehicles per day. The Pleasanton General Plan would need to extend Stoneridge Drive to Santa Rita Road to provide sufficient access to both proposed regional shopping center and Station Q.

Since Station Q is located more than 1,500 feet from the proposed Stoneridge Shopping Center and is on the far side of the freeway, it would be highly desirable to have a people mover to link the station with the shopping center.

Pleasanton Station D
Stoneridge/Foothill Site (Red, Green and Blue Lines)

The 14-acre site, accommodating 1,300 parking spaces, is at the south edge of the proposed Stoneridge Shopping Center and is served by Stoneridge Drive on the south and Foothill Road on the west. The proposed Stoneridge Drive interchange at I-680 will provide freeway access. Since the site adjoins the shopping center, the station would suffer the same congestion as the shopping center. Heavy congestion would occur during the evening peak period when commuters and shopping trips coincide.

By 1990 Foothill Road is expected to carry 40,000 vehicles per day in the vicinity of the shopping center resulting in serious congestion. Transit

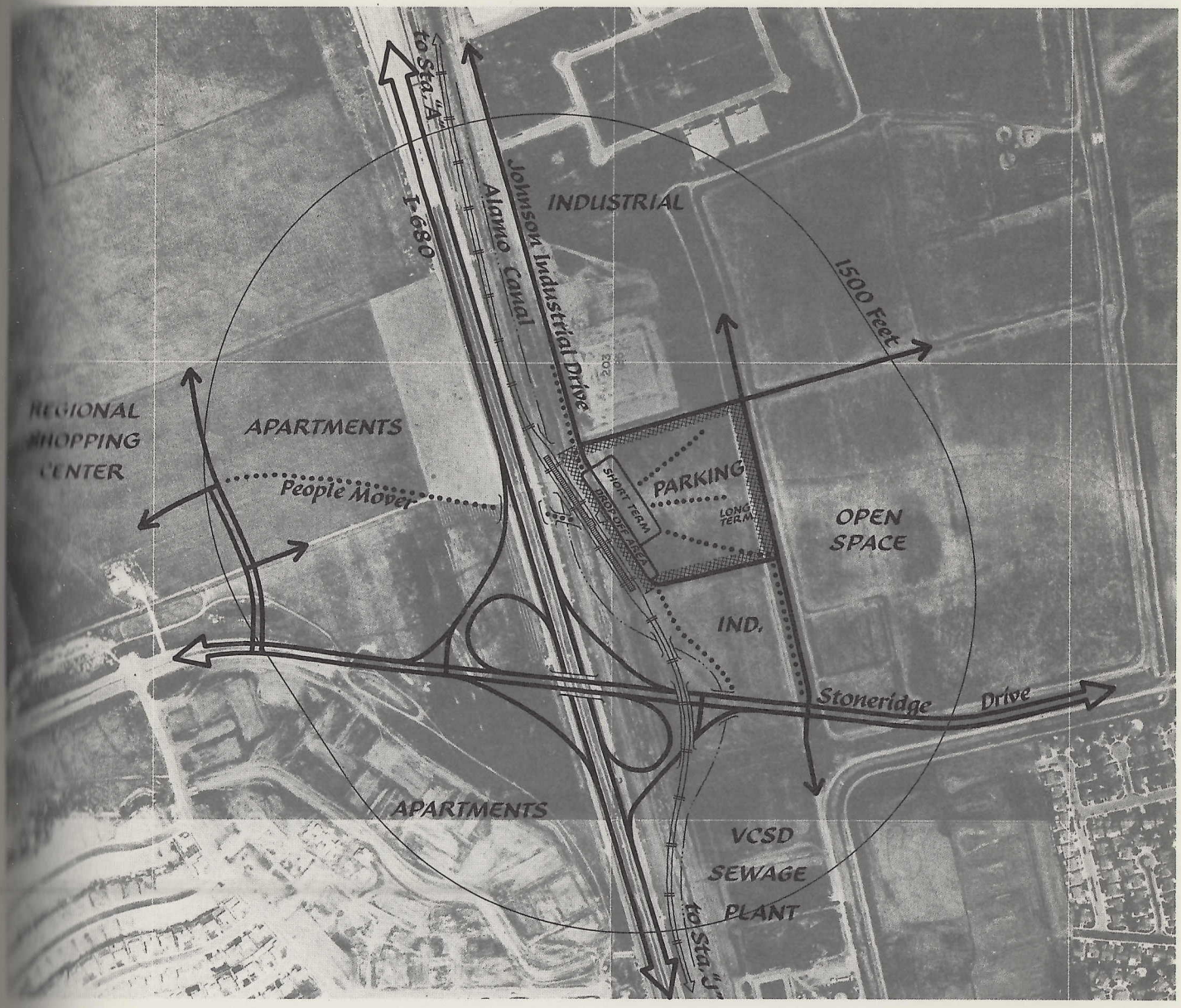


Schematic Site Plan

Pleasanton Station D
Stoneridge/Foothill
Dublin Canyon Corridor
Red, Green, Blue Lines

Livermore-Pleasanton BART Extension

N
0' 400'



Schematic Site Plan

Pleasanton Station Q
Stoneridge/I-680
San Ramon Valley Corridor
Orange Line

Livermore-Pleasanton BART Extension

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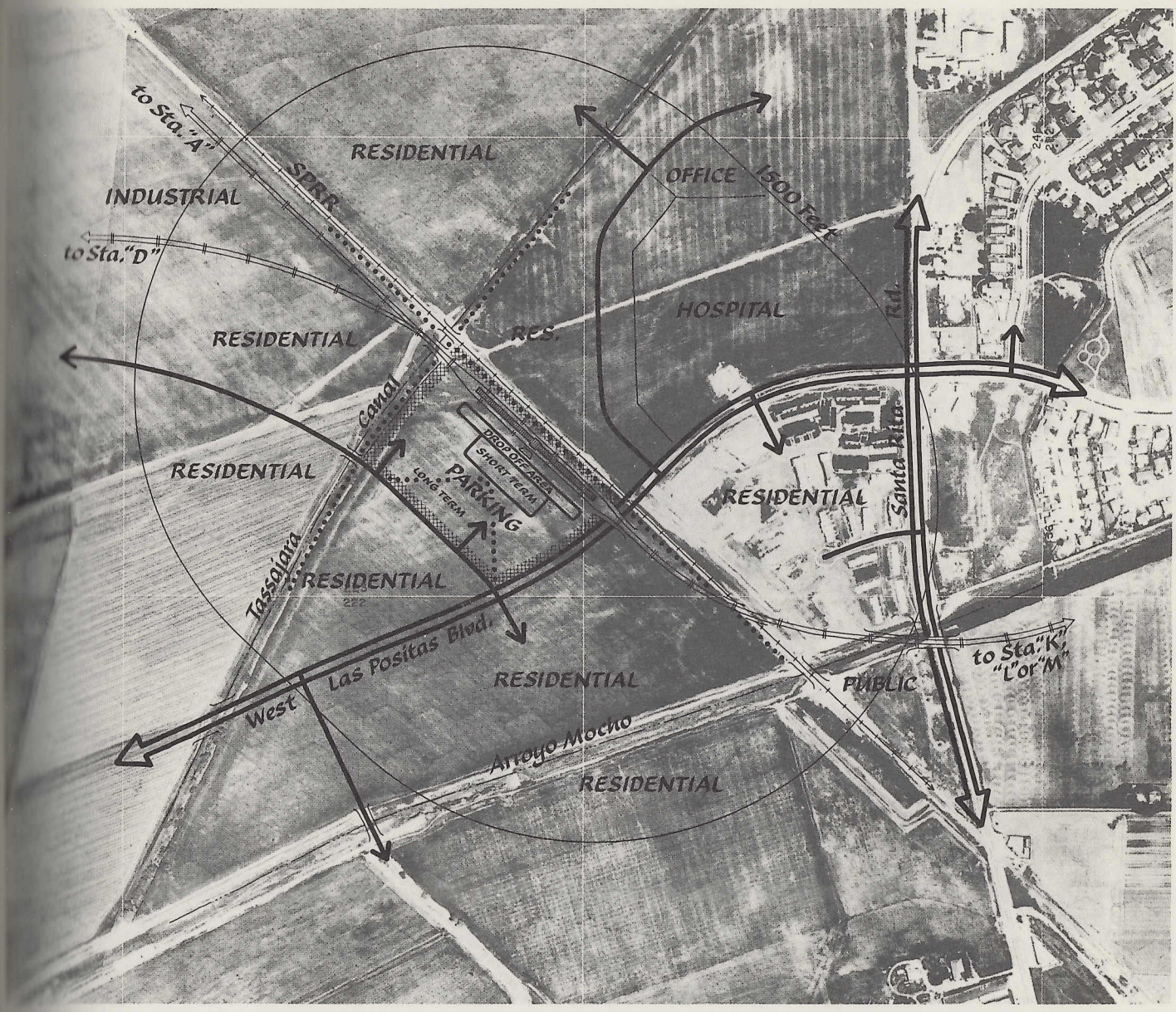

Schematic Site Plan

Pleasanton Station F
Las Positas/SPRR
Red, Green, Yellow, Brown Lines

Livermore-Pleasanton BART Extension

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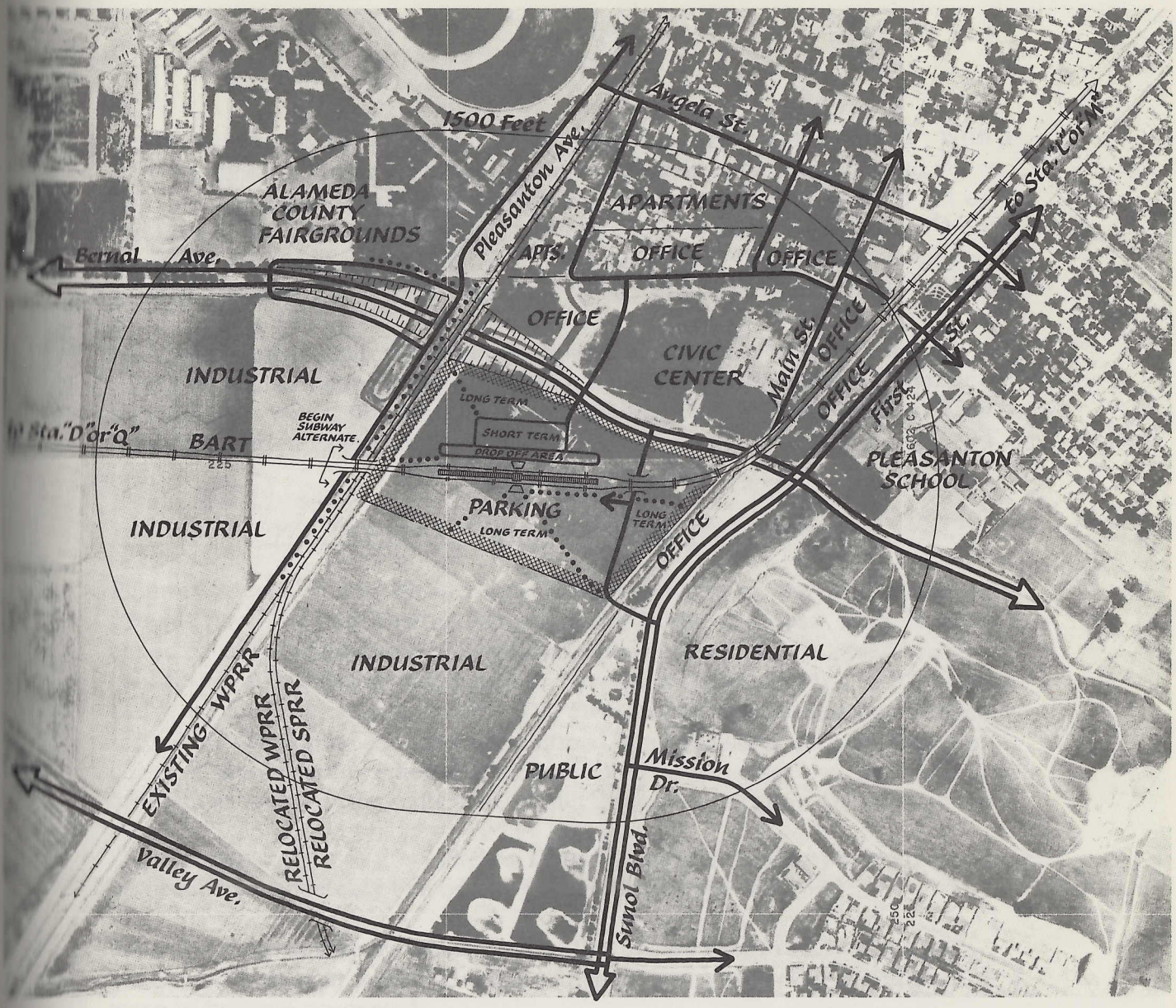


Schematic Site Plan

Pleasanton Station J
Bernal/Main
Blue, Orange Lines

feeder service to BART could alleviate this problem to some extent. With a BART extension through the Dublin Canyon corridor, Station D would serve not only northwest Pleasanton, but also would be the only station for all of Dublin and San Ramon. The majority of transit patrons would arrive from the north via I-680 or Foothill Road, probably preferring the more smoothly flowing freeway. A full interchange at Stoneridge Drive would be essential.

Because the shopping center is not yet under construction, it should be possible to coordinate development of the station and the shopping center, avoiding on-site traffic conflicts and providing a convenient pedestrianway from the station to the shopping mall.

Pleasanton Station F
Las Positas/SPRR Site (Red, Green, Yellow and Brown Lines)

Primary access to this 20-acre, 2,000-space site in northwest Pleasanton is provided by West Las Positas Boulevard and Santa Rita Road, both of which are expected to be uncongested. Secondary access would be via a new street connecting a residential area west of Tassajara Canal with the BART station and West Las Positas Boulevard. The Pleasanton General Plan now proposes industrial development on the agricultural land adjoining the site, but the changes shown on the schematic design would be necessary to take advantage of the high walk-to-ride potential of this attractive location for commuters.

A grade separation of the S.P. tracks and West Las Positas Boulevard will not be needed because only one or two trains a week use the line.

Because of the northerly location of Station F, patrons from central and southern Pleasanton would have the choice of using this station if Station D were to become congested.

Pleasanton Station J
Bernal/Main Site (Blue and Orange Lines)

This 20-acre station site is between the W.P. and the existing S.P. tracks immediately south of relocated Bernal Avenue. The heavy rail traffic resulting from consolidation will necessitate construction of a grade separation, preferably an underpass, at Bernal Avenue. Pleasanton Avenue could extend south to the extension of Valley Avenue with a partial interchange connecting to Bernal Avenue at the grade separation. If the S.P. tracks are relocated to the W.P. right of way through Pleasanton, access to the station from Sunol Boulevard would be possible.

From a vehicular access standpoint, this station is one of the best in the entire Valley. However, the southerly location of Station J will require significant out-of-direction travel for many Pleasanton riders and a high percentage will find it more convenient to use Station D or Q.

Since this station would be within walking distance of the Alameda County Fairgrounds, it will bring significant relief from current congestion experienced during major events. Station J also would be within easy walking distance of the new Pleasanton civic center, but not the retail business district.

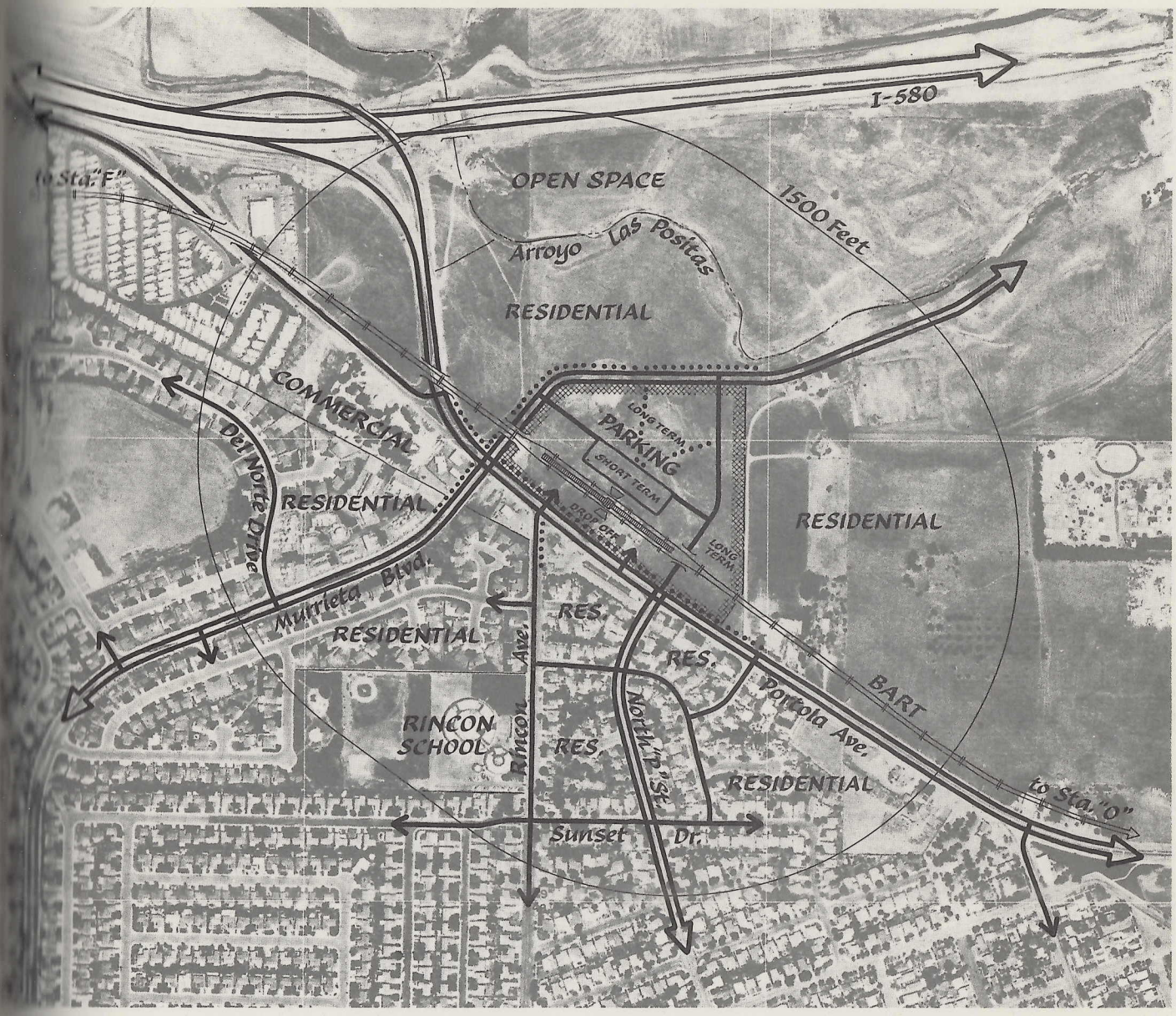
Livermore Station K
Portola/Murrieta Site (Red and Yellow Lines)

Four arterial streets serve this 9-acre, 800-space station site at the northwest edge of Livermore: Portola Avenue, Murrieta Boulevard and its planned extension to North Livermore Avenue, Rincon Avenue, and North "P" Street. Of these streets, only Portola Avenue is expected to experience significant congestion by 1990. All of Livermore north of the railroad tracks would have good access to this station, and most of south Livermore could reach it via Murrieta Boulevard or North "P" Street, avoiding downtown congestion. Patrons from southeast Livermore would follow Livermore Avenue through downtown to reach the station via Portola Avenue. Livermore Avenue is expected to be severely overloaded by 1990, as is the section of First Street between Livermore Avenue and North "L" Street.

This station would cause some out-of-direction travel by patrons from southwestern Livermore and, because the station is towards the north edge of the City, the average travel distance to the station is greater than for Station L or M.

Livermore Station L
Stanley/Murrieta Site (Green, Blue, Brown and Orange Lines)

This nine acre site on the basic at grade or alternative aerial alignment through Livermore is at the intersection of Murrieta Boulevard and East Stanley Boulevard with the 800-space parking area split by Murrieta Boulevard. The western portion would be used only for long-term parking and would be connected to the eastern portion by a bridge across depressed Murrieta Boulevard.

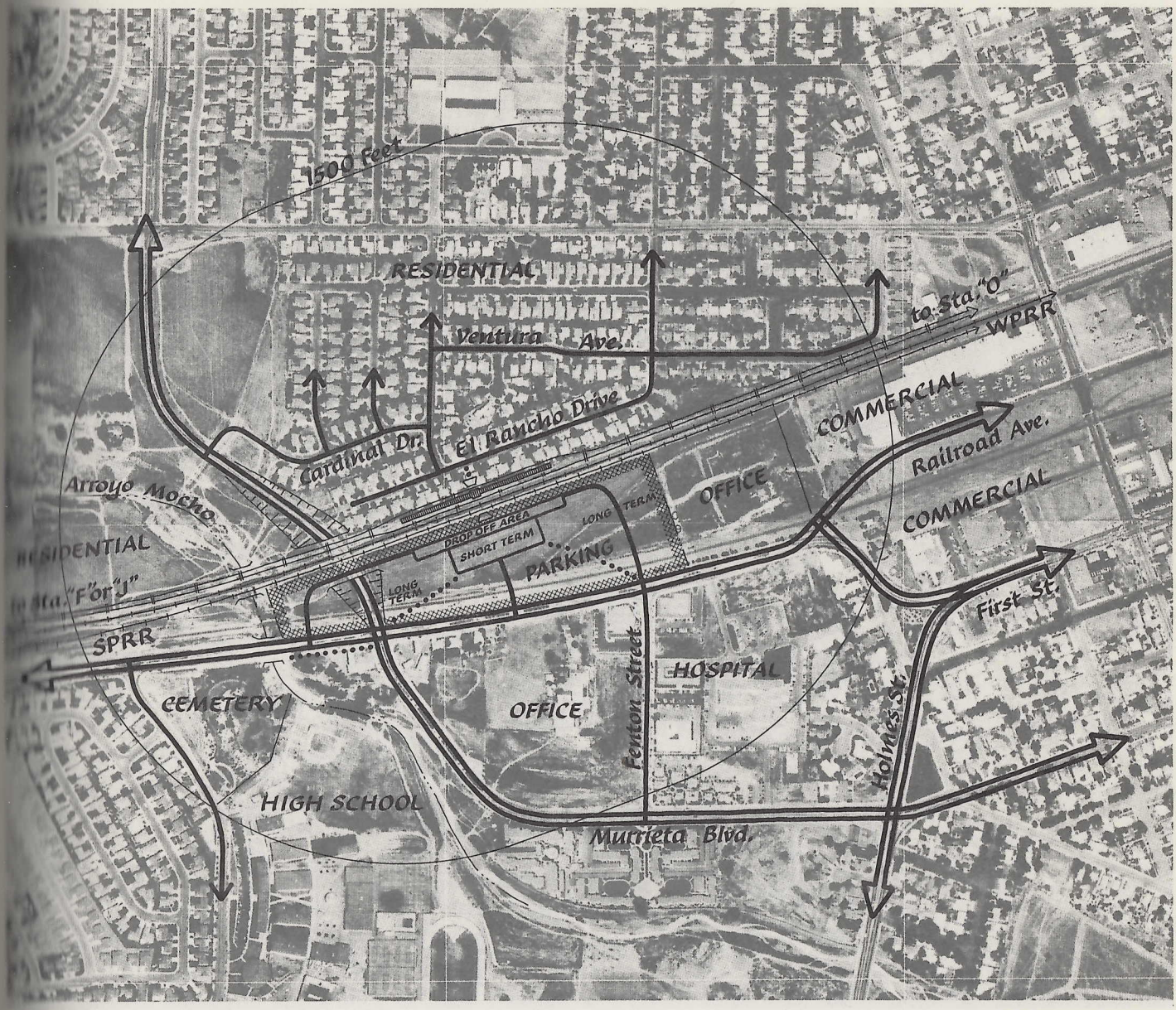


Schematic Site Plan

Livermore Station K
Portola / Murrieta
Red, Yellow Lines

ivermore-Pleasanton BART Extension

N
0' 400'



Schematic Site Plan

Livermore Station L
Stanley/Murrieta
Green, Blue, Brown, Orange Lines

N

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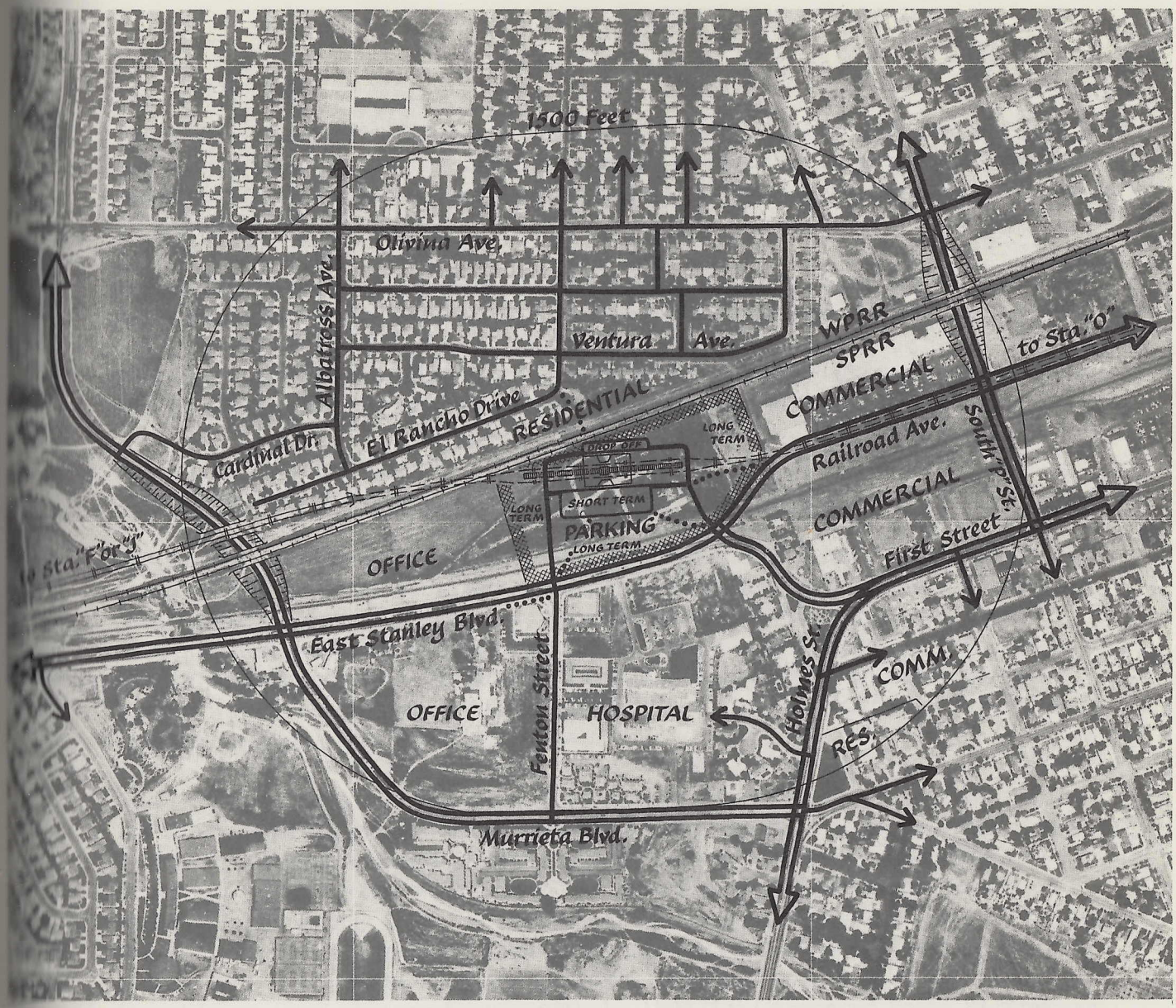


Schematic Site Plan

Livermore Subway Station L
Stanley / Holmes
Green, Blue, Brown, Orange Lines

Livermore-Pleasanton BART Extension

N
0' 400'

The station platform would be north of the W.P. and relocated S.P. tracks, requiring patrons to cross over or under both tracks to reach the mezzanine. To minimize neighborhood disruption on the north side of the station, only pedestrian access from El Rancho Drive is proposed.

Vehicular access would be from East Stanley Boulevard at three points: one west of Murrieta Boulevard, one east of Murrieta Boulevard and one at Fenton Street.

The only significant congestion anticipated by 1990 on arterials serving this station will be on East Stanley Boulevard west of Murrieta Boulevard.

Livermore Subway Station L
Stanley/Holmes Site (Green, Blue, Brown and Orange Lines)

On the alternative subway alignment through Livermore, Station L is approximately 1,000 feet east of the site of Station L on the at grade or aerial alignment. This easterly location is necessary because the subway alternative follows a different horizontal and vertical alignment. The nine acre station site is between Fenton Street, and South "S" Street, the W.P. tracks and East Stanley Boulevard. Access would be from two points on Stanley Boulevard: one opposite Fenton Street and the other opposite South "S" Street.

The City of Livermore is planning to reconstruct the intersection of First Street, and East Stanley Boulevard with South "S" Street. Current plans show S.P. tracks relocated adjacent to the W.P. and Railroad Avenue connected to East Stanley Boulevard. First Street will form a T intersection with East Stanley Boulevard/ Railroad Avenue, and South "S" Street will be removed. The alignment of Homes Street at its intersection with First Street directs traffic easterly and would complicate access to the station from the south. The intersection of First and Holmes Street is expected to carry heavy traffic by 1990 if the proposed Route 84 Freeway near Isabel Avenue is not yet constructed. All traffic arriving from the north via Murrieta Boulevard would have to make a left turn at East Stanley Boulevard instead of the easier right turn to Station L as in the at grade and aerial alignments, and then another left turn from East Stanley Boulevard into the station. Congestion would be greater than at Station L in the at grade and aerial alignments.

A pedestrianway should be built across the railroad tracks to serve the El Rancho Drive area. This site is within walking distance of several major commercial developments, as well as the Valley Memorial Hospital.

Livermore Station M
Livermore Avenue/SPRR Site (Green, Blue, Brown and Orange Lines)

On the basic at grade or alternative aerial alignment Station M would be immediately north of the W.P. tracks. The 11-acre site is bounded by Chestnut Street on the north, Livermore Avenue on the east, Railroad Avenue on the south, and "L" Street on the west and will be bisected by the W.P. tracks and the relocated S.P. tracks. Underpasses are planned at North Livermore Avenue and North "L" Street as part of the City's railroad consolidation project. Access can be only from Chestnut Street and from Railroad Avenue and because of the railroads there can be no direct vehicular connection between the two sections of the site. Two parking levels would provide 800 spaces.

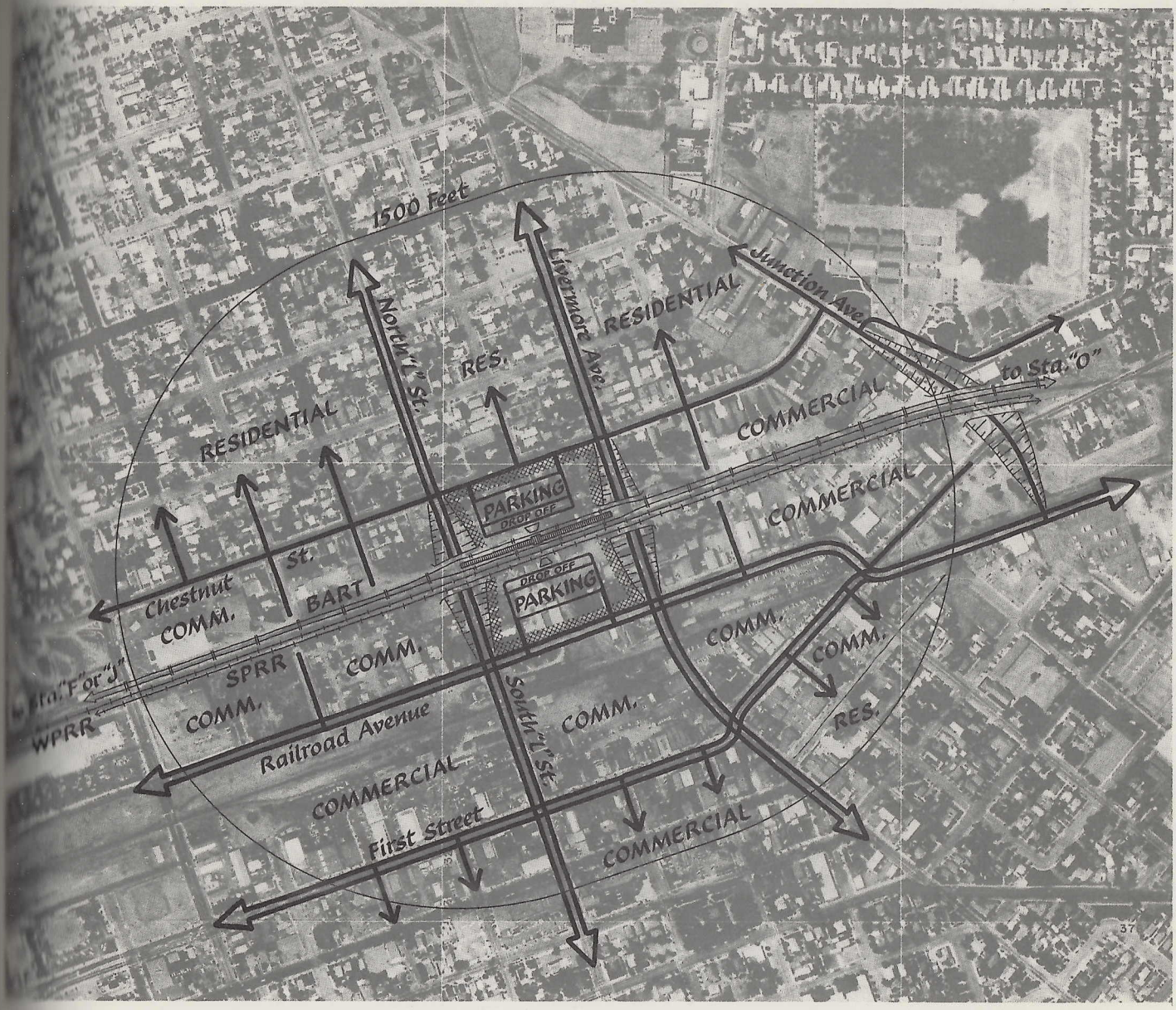
CALTRANS 1990 projections show considerable congestion on several downtown streets, particularly Livermore Avenue, Railroad Avenue and First Street. Postponement of construction of the proposed Route 84 Freeway beyond 1990 will impose an additional 50,000 trips per day on Livermore streets, severely congesting Holmes Street, Livermore Avenue, "L" Street, Railroad Avenue, and First Street, and interferring with heavy turning movements for BART traffic at "L" Street and Livermore Avenue. The station would be within 1,500 feet of most of the older part of downtown, but would be beyond walking distance of newer automobile-oriented commercial developments to the west. Its location would require out-of-direction travel for patrons residing west of "P" Street, causing some of these riders to travel to Pleasanton to get on BART, rather than backtrack through downtown Livermore.

Livermore Subway Station M
Livermore Avenue/Railroad Avenue (Green, Blue, Brown and Orange Lines)

On the alternative subway alignment through Livermore, Station M would be 300 feet south of its location in the other alternatives. The station mezzanine and platform would be under Railroad Avenue between Livermore Avenue and "L" Street.

Livermore Station O
Mines/First Site (All Lines)

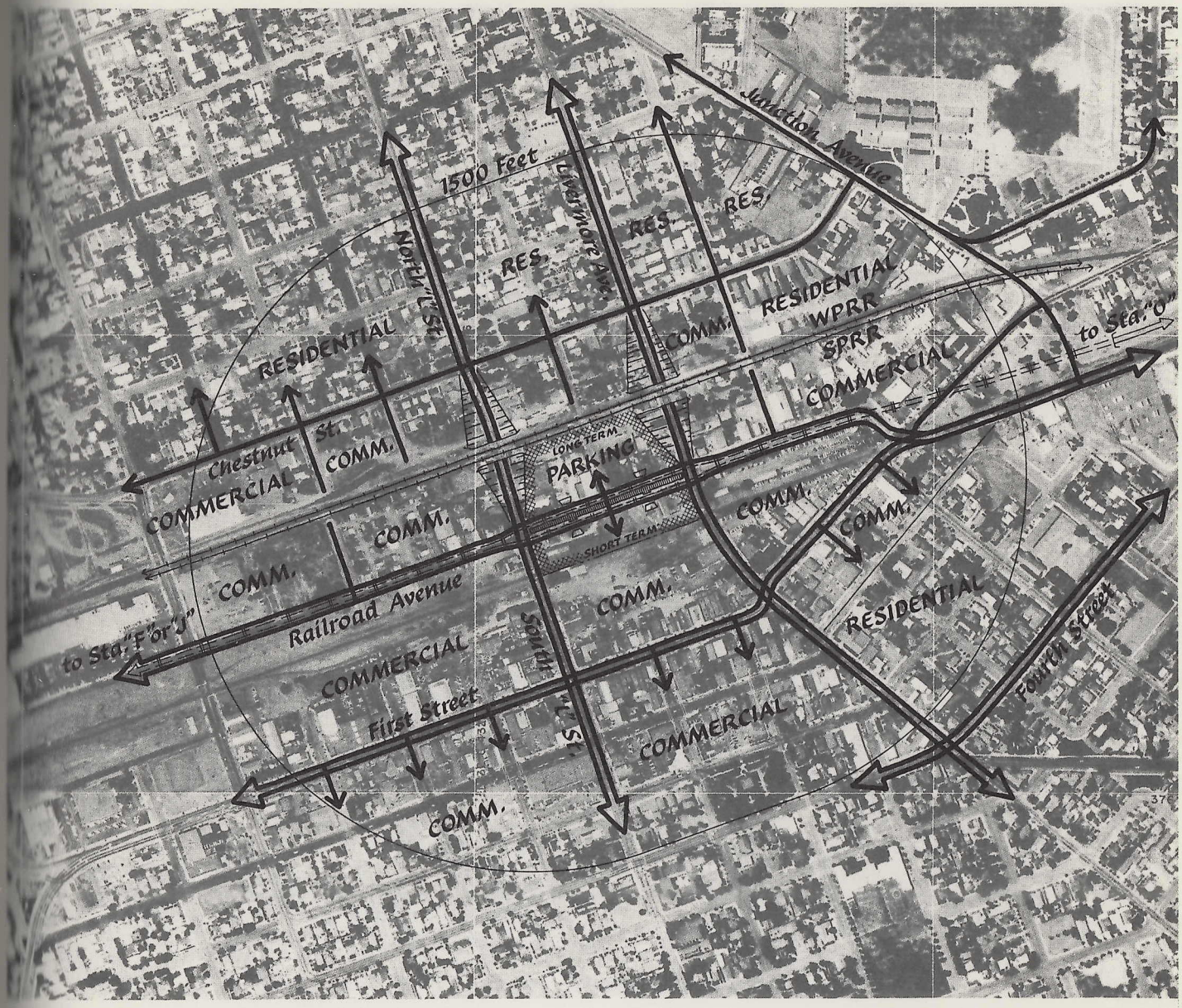
Station O for the at grade or aerial alignments would be on a 13 acre site (800 parking spaces) east of the proposed North Mines Road extension and immediately north of the W.P. tracks. This site is dictated by the BART



Schematic Site Plan

Livermore Station M
Livermore Ave./SPRR
Green, Blue, Brown, Orange Lines

N
0' 400'



Schematic Site Plan

Livermore Subway Station M
Livermore Ave./Railroad
Green, Blue, Brown, Orange Lines

N
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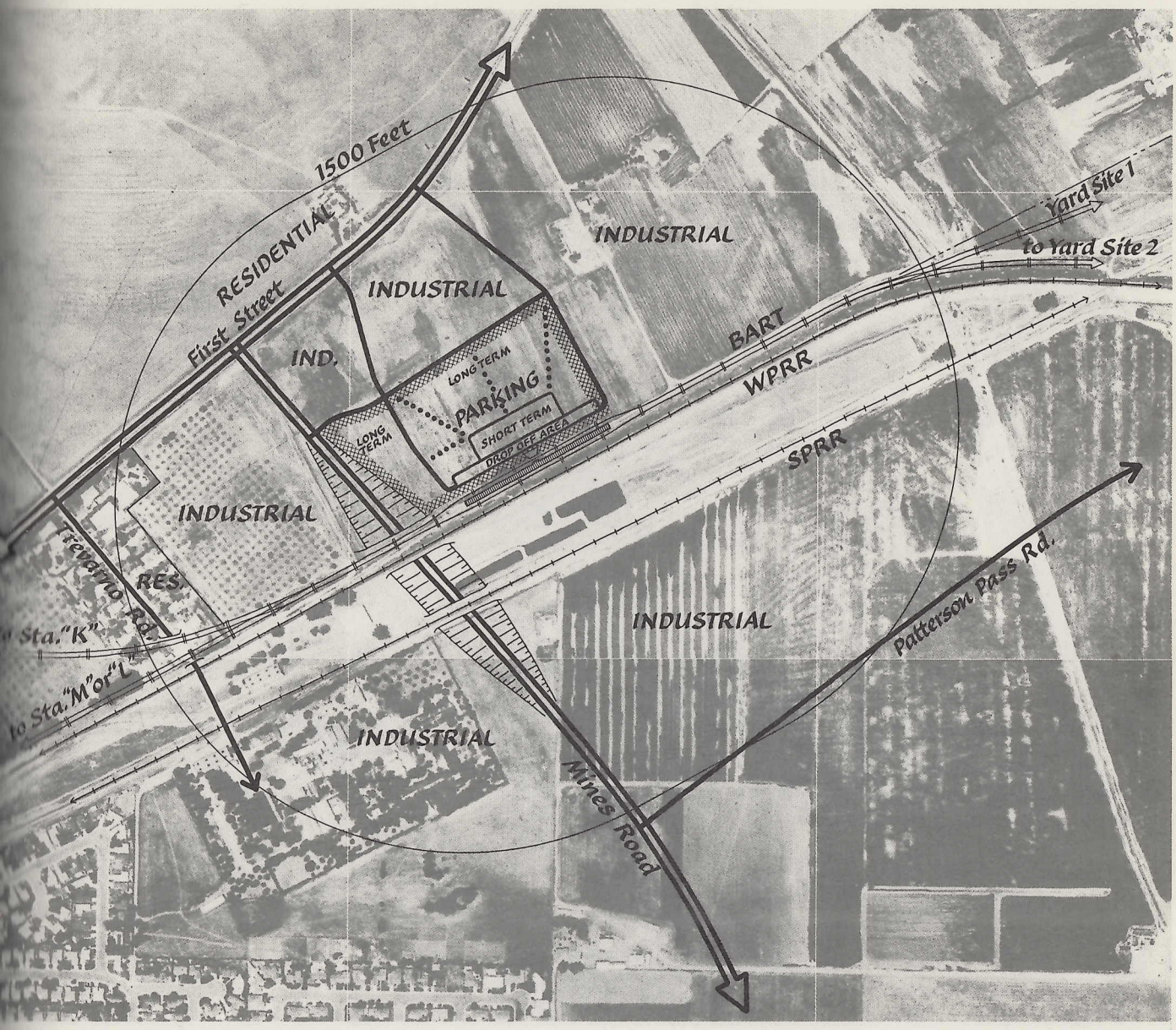

Schematic Site Plan

Livermore Station O
Mines/First
All Lines

ermore-Pleasanton BART Extension

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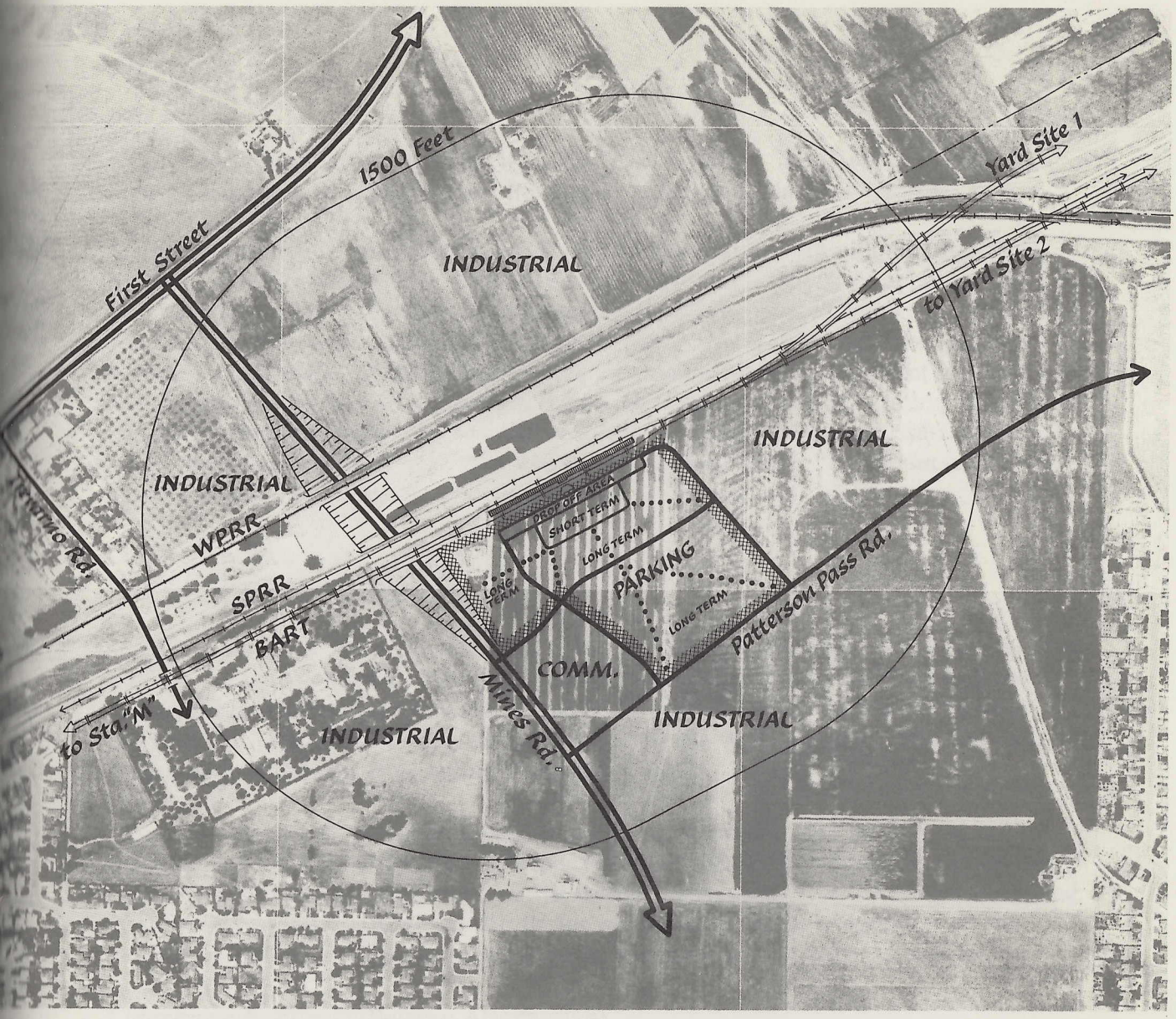

Schematic Site Plan

Livermore Station O
Mines/Patterson Pass
Green, Blue, Brown, Orange Lines
(subway alternate)

N

0' 400'

alignment adjoining the north side of the W.P. tracks. The line continues east of Station O to either Yard Site 1 or 2. (See Red Line description.)

Access points to the mezzanine would be provided from both sides of Railroad Avenue, which is planned to become a major arterial. The four acre parcel north of Railroad Avenue would have 800 long-term parking spaces on two levels. The one acre southern parcel would be used for short-term parking, bus, and taxi service. All traffic to the station would be concentrated at one point on Railroad Avenue and at the two major intersections on either side of the station site, causing more severe congestion than the at grade or aerial alignment Station M site. As in the other alternatives, it is assumed that both North "L" Street and Livermore Avenue will be grade separated at the W.P. and S.P. tracks.

Livermore Station O
Mines/First Site (All Lines)

Station O would be on a 13 acre site (800 parking spaces) and, unless the subway alternative were chosen, Station O would be east of the proposed Mines Road extenxion and immediately north of the W.P. tracks. This site is dictated by the BART alignment adjoining the north side of the W.P. tracks. The line continues east of Station O to either Yard Site 1 or 2.

Access to Station O would be from Mines Road extension and East First Street. Because 1990 traffic volumes are expected to reach 32,000 vehicles per day on East First Street in the vicinity of the station, congestion can be expected during peak periods. Mines Road traffic is not expected to cause congestion at the station entrances. A grade separation is assumed at the railroad tracks.

Livermore Station O (Subway Alternative)
Mines/Patterson Pass Site (Green, Blue, Brown, and Orange Lines)

On the subway alignment, Station O would be in the northeast quadrant of extended Mines Road and East Patterson Pass Road. The northern boundary of the 13 acre, 800 space station site would be the S.P. tracks. A grade separation at Mines Road is assumed.

STATION SERVICE AREAS

The tributary population determined by drawing traffic sheds for each Valley station varies depending on the sequence of stations along a line. If one line

TABLE 7: COMPARISON OF 1990 TRIBUTARY POPULATION WITH ALTERNATE COMBINATIONS OF STATIONS

	Stations								
	San Ramon	A	D	Q	J	F	L	M	K	O
Dublin Canyon Corridor Alternates										
Blue			96,800		43,700		57,800			29,700
Blue			96,800		43,200			63,300		23,700
Green			99,800			39,600	57,800			29,200
Green			99,800			39,600		63,300		23,700
Red			99,800			39,600			56,100	30,900
San Ramon Valley Corridor Alternates										
Orange	29,000	38,000		29,800			57,800			29,200
Orange	29,000	38,000		29,800				63,300		23,700
Brown	29,000	48,000				63,000	57,800			29,200
Brown	29,000	48,000				63,000		63,300		23,700
Yellow	29,000	48,000				63,000			56,100	30,900

had an equal 1990 tributary population at each station, all other factors being equal, that line would provide the greatest traveler benefits. Unequal factors include varying socio-economic characteristics and work places and, therefore, different propensities to ride BART.

Tributary populations for stations on Dublin Canyon lines range from a high of 95,000-100,000 at Station D to a low of 23-30,000 for Station O. The allocation of population to each station for each alternative combination of stations shown in Table 7 indicates that the sequence D-J-L-O would have the most even distribution. With an L-O combination in Livermore, the 1990 tributary population to L is 28,600 more than to O, while with an M-O combination the difference jumps to 38,600 people, indicating more potential congestion at Station M than at Station L.

Station D would serve a tributary area more than twice as populous as J or F. The difference between a D-J combination and a D-F combination is 13 per cent; 53,100 as opposed to 60,200. Station D, with by far the largest tributary population, logically would rely heavily on a feeder bus line bringing passengers from the San Ramon Valley.

The tributary population for Livermore stations is not affected by corridor choice. However, the allocation of population to the northwest Pleasanton and Dublin stations is quite different for San Ramon Corridor lines because of the greater variation in station location.

TRAVEL TIME

To measure the effect of different station sets on total travel time for Valley BART patrons, the tributary population and average travel time from home to station was calculated for each station in combination with all sets of stations. For Livermore patrons line segment F-L-O would minimize travel time from home to F, and the penalty for F-K-O would be 5.7 per cent and for F-M-O 5.9 per cent, a maximum difference of about half a minute per trip for the average rider.

The choice of a northern or a southern route creates more pronounced differences. Line segment D-F would cause the average Pleasanton rider to travel 2.3 minutes longer than if D-J were built, but Livermore patrons would save 1.1 minutes on the northern route. For the Valley as a whole, the southern route has a half minute advantage.

COMMUNITY IMPACTS

Evaluations of traffic disruption and station disruption, parking and internal circulation have been prepared from the schematic station designs and the ordinal rankings are shown in Table 8.

More precise measures of congestion will be available from RTTPP Task III because the street and freeway traffic volumes will be projected for each alternate network under each growth assumption, but even with this model it is unlikely that a precise quantitative distinction can be made between local stations.

The number of single and multi-family housing units and the number of businesses and estimated number of employees that would be displaced by each Valley station is shown in Table 9. The only major displacements would occur at either of the sites for Station M. So it would have the greatest adverse community impact.

The economic impact of alternate station locations has two significant measures: the impact on the cost of housing and the impact on the cost of travel. By these criteria, an outlying station that could be surrounded by new, high-density housing would be most desirable because it would remove no housing from the existing supply and because it would allow the maximum number of potential BART patrons to live within walking distance, thus minimizing transportation cost (assuming the site did not require longer trips for those using bus or car). This analysis assumes that if BART is extended to the Valley total assessed valuation and total employment and the value of retail sales and services will be the same for any set of stations that provides good service. Economic activity that might locate near a particular station is assumed to locate elsewhere in the Valley if that station is not built. Similarly, land value increases resulting from potential apartment development near a station represent, over the long term, a transfer from alternative sites in the Valley that would not be occupied by apartments.

The assumption that travel is minimized by maximizing housing within walking distance stems from an analysis showing that housing at 20 units per acre is likely to produce 50 per cent more BART trips per acre than industrial or commercial development would attract, even assuming a high average density of 40 employees per acre. Unless typical metropolitan fringe employment and

TABLE 8 : EVALUATION OF ACCESS AND PARKING AND INTERNAL CIRCULATION AT VALLEY STATIONS BASED ON SCHEMATIC STATION DESIGNS.

Station	Access to Station Site	Parking & Internal Circulation
D	D	C
Q	C	C
F	B	B
J	A	B
K	A	B
L (aerial or at grade)	B	C
L (subway)	C	C
M (aerial or at grade)	D	D
M (subway)	E	D
O (aerial or at grade)	B	B
O (subway)	C	B

TABLE 9: DISPLACEMENT

Valley Stations	Residences		Businesses	
	Single Family	Multi-Family	Number	Estimated Employees
D	0	0	0	0
Q	0	0	0	0
J	0	0	0	0
F	0	0	0	0
L	0	0	0	0
M	11	13	25	76
L Subway	0	0	0	0
M Subway	1	0	28	93
O	0	0	0	0
O Subway alternate	0	0	0	0

residence patterns are greatly altered, most of the persons working in the Valley will live there and the percentage using BART will be small.

Around Stations D, Q, F, O, and, to a lesser extent K, the economic impact primarily is a function of the development potential rather than the effect on existing land uses. Conversely, the primary effects of Stations J, L, and M have to be considered in relation to the existing community. At outlying locations site costs would be less than half as high as in already built-up areas, and could be held much lower if BART were granted excess condemnation power. Current studies of the impact of the existing BART system will be extremely helpful to planners in the future, but little work has been accomplished to date which shows more than the fact that a good deal of land speculation is occuring around BART stations.

In downtown Livermore and Pleasanton a BART station's economic impacts would be much more complex. Examination of the characteristics of the housing stock within the 1,500 foot primary impact zone around each station using 1970 Census block statistics (Table 10) offers a basis for predicting the effects of a BART station on existing land uses and housing costs given certain assumptions about market behavior and the socio-economic characteristics of BART patrons.

Of the three Livermore stations, Station L's impact zone probably would generate the greatest walk-to-ride patronage. Not only do the greatest number of people live within the 1,500 foot area but most of these people own relatively new homes with an average value in 1970 of over $19,000. About one quarter lived in rented housing at an average rent of $147 per month, the highest average near a station site in Livermore. These indicators, combined with a small proportion of the Station L population older than 62, suggests a high incidence of employed household heads that would be potential BART commuters. Around Station M almost three quarters of the 1,600 people within 1,500 feet in 1970 rented at an average of $110 per month. Owner-occupied housing was worth on the average 15 per cent less around Station M than around Station L, and the bulk of the housing valued below $16,000 was within two or three blocks of the station. Around Station M more than three times as many people were over 62 years old as around Station L.

If Station M were selected, there probably would be little short-range impact on the surrounding housing. Large rent increases would not be likely because those able to pay more would want newer or larger units. Little demolition for housing would occur because site costs would be higher than for apartment land near Pleasanton or Dublin stations closer to BART commuter destinations.

TABLE 10: SOCIO-ECONOMIC CHARACTERISTICS OF STATION AREA
1,500 FOOT IMPACT ZONES, 1970

Impact Zone	Population		Owner Occupied Housing Units		Renter Occupied Housing Units		
	Number	Per Cent Over 62 Years	Number	Average Value	Number	Average Rent Per Month	Per Cent of Units
STATION M	1,637	12	158	$16,535	397	$110	72
STATION L	1,932	3.5	334	19,132	114	147	25
STATION K	892	5.7	195	21,428	43	142	18
STATION J	236	13	29	19,700	62	114	68

Source: 1970 U.S. Census

However, owners would anticipate change and would defer maintenance, thus advancing the time of conversion to new, higher-rent housing or commercial use and loss of the present low and moderate income housing supply.

DOWNTOWN VS. OUTLYING STATIONS

The critical station location decision to be made in the Valley is I or J (downtown) vs. F (outlying) in Pleasanton and L or M (downtown) vs. K (outlying) in Livermore. Selection of I or J would automatically eleminate K because a line segment connecting them would be the least desirable of all combinations examined in the early phases of this study. It would add $10 million to the construction cost alone of the most expensive Valley lines and impose a travel time penalty of nearly one minute on Valley trips between Livermore and Pleasanton.

The evaluations assume Station J and reject Station I in downtown Pleasanton, for the following reasons:

J would require less total travel to BART than I.

J would have good traffic service, while I would create severe congestion.

Even with multi-level parking I would require acquisition of 18 housing units and 2 businesses, while J would be on open land.

J potentially would have more employment within walking distance.

J would be within walking distance of the Alameda County Fairgrounds.

Land speculation resulting from selection of I would make off-street parking for downtown more difficult to acquire and would reduce the supply of low cost housing and low cost commercial space.

There is no evidence that increased retail sales to BART patrons would offset losses due to congestion.

J would be compatible with the Pleasanton Downtown Plan and is favored by the City staff.

From a Pleasanton viewpoint the choice of J or F has arguments on both sides:

J would cut BART trip times for residents an average of two minutes.

Rather than make the longer trip to Station F on city streets, many residents in south Pleasanton would take the freeway to Station D, increasing congestion there.

J would relieve automobile congestion at Fairgrounds events.

J would connect downtown Pleasanton with downtown Livermore.

J would be more convenient for bike riders because average home-to-station distance would be shorter.

J would help establish the identity and importance of the civic center area and would attract office employment to the area. It would give impetus to industrial and office development of the San Francisco Water Department lands south of Bernal Avenue.

J would hasten the loss of low and moderate income housing north of Bernal Avenue.

F would maximize the walk-to-ride population and would serve the new hospital site.

F would result in less line disruption than J, particularly if aerial structures were to be built through downtown Pleasanton.

F would be a more attractive alternate than J for Pleasanton, San Ramon and Dublin BART patrons experiencing congestion at Station D.

Livermore

Although M was not eliminated from consideration, the basic alternative assumes Station L in downtown Livermore for the following reasons:

L would cause less congestion because it would share patronage more evenly with Station O and because the site has better traffic access than M.

L would attract more walk-to-ride commuters than M.

L would attract as many or more in-commute trips as M.

M would cause attrition in Livermore's low and moderate cost housing supply.

There is no evidence that increased retail sales to BART patrons using Station M would offset losses due to congestion.

An evaluation of Station L vs. Station K, the outlying site alternative in Livermore, favors L for the following reasons:

Average travel time to K for those who would use it is 10 per cent greater than if L were selected.

Lines serving K cause greater disruption and displacement in Livermore than lines serving L.

K offers less walk-to-ride potential than L.

K has little in-commute potential and would carry fewer intra-Valley BART trips than L.

VALLEY LINE SEGMENTS

Valley lines studied fall in two broad categories -- southern lines (Blue and Orange) that serve Pleasanton Station J, and northern lines (Red, Green, Yellow, Brown) that generally parallel I-580 about six miles to the south.

LINE DESCRIPTIONS

Red Line

From Station D, the Red Line would proceed east on aerial structure along the north side of Stoneridge Drive, crossing over I-680 and the Alamo Canal just north of the proposed Stoneridge Drive interchange. The Red Line then would cross over the westbound lanes of Stoneridge Drive and follow the median to Hopyard Road where it would drop to grade, turn southeast, and climb to aerial structure along the west side of the S.P. track to Station F.

Continuing south on aerial structure, BART would turn east, cross over the S.P. track, the Arroyo Mocho and Santa Rita Road, and follow the south side of the Arroyo Mocho at grade for two miles.

Crossing over the Arroyo Mocho and El Charro Road BART would proceed east at grade between the quarries and the future extension of West Las Positas Boulevard, crossing under future West Las Positas Boulevard and following the south boundary of a planned Livermore Municipal Airport runway at grade. Just past the airport, the line would turn northeast passing over the Livermore Sewage Treatment Plant ponds and Kitty Hawk Road on aerial structure and continuing to the mobile home park south of the Portola Drive/I-580 interchange, which would be severed. An aerial structure would carry BART over the south frontage road and Portola Avenue to Station K.

East of Station K the Red Line would follow the north side of Portola Avenue on aerial structure to Lee Street where it would drop to grade until approaching East First Street. After crossing over East First Street, the Red Line would continue east on aerial structure, pass over Trevarno Road, and turn northeast on an embankment adjoining the north side of the W.P. tracks, and cross the planned Mines Road extension to Station O.

Two alternative 15-acre yard sites are located a half mile east of Station O. Site 1 is immediately north of the S.P. track and Site 2 is between the S.P. and W.P. tracks. Site 1 would be the preferred location because it would not require an aerial structure over the S.P. tracks, and Station O could be at grade.

Green Line

From Station D to the southwest corner of the Livermore Municipal Airport, the Green Line is identical to the Red Line. At the Airport the Green Line would turn southeast, continue at grade under the future West Las Positas Boulevard overhead, skirt the gravel quarries, head southeast to the W.P. tracks, then proceed at grade along the north side of the tracks east of Murdell Lane, crossing depressed Murrieta Boulevard to Station L.

Underpasses at North "P" Street and North Livermore Avenue are scheduled for construction in the first phase of the Livermore railroad consolidation project. To accommodate a BART line at grade, Murrieta Boulevard, North "L" Street, Junction Avenue and First Street would have to be grade separated. The railroad consolidation project will relocate two miles of S.P. track to a line 20 feet south of the W.P. main line. The existing S.P. grade crossing at Murrieta Boulevard will be moved north and grade crossings at "I" Street, "K" Street and Standard Oil's private crossing near the eastern City limits will be closed.

First phase relocation will make 30 acres in downtown Livermore available for commercial development, and the second phase will free 18 additional acres west of the Livermore Valley Square Shopping Center. Phase 2 will realign tracks at the western edge of the City and includes construction of an underpass at Murrieta Boulevard.

In downtown Livermore, BART would be at grade north of the consolidated railroad tracks. The centerline of the 40-foot BART right of way would be 60 feet north of the W.P. main line track, requiring additional right of way. The 24 feet average width of additional right of way between Station L and North "L" Street would remove 17 single-family residences. The segment between North "N" Street and East First Street would require acquisition of 33 to 40 feet taking ten businesses.

East of downtown, the Green Line continues along the north side of the Western Pacific tracks, joins the Red Line several hundred feet east of Trevarno Road, and continues to Station O, in the same way as the Red Line.

Blue Line

East of Station D the Blue Line would turn south, cross over Stoneridge Drive and I-680, descend to grade and run between the freeway and the Alamo Canal to the Arroyo Valle. Between Stoneridge Drive and the Arroyo Mocho, the 40-

foot BART right of way would consist of 25 feet from the I-680 right of way and 15 feet from the Alamo Canal right of way. From the Arroyo Mocho to a point approximately 1,000 feet north of the Arroyo Valle, BART would use the freeway and Alamo Canal rights of way.

South of the Arroyo Valle, the Blue Line would turn east, cross over Bernal Avenue and continue east 700 feet south of Bernal Avenue on an aerial structure to Station J.

East of Station J, the Blue Line would turn on a 50 mph curve toward the S.P. right of way, passing over the intersection of Main Street and Bernal Avenue Extension, continue within the right of way until it approaches the Radum Wye, where it would cross over the S.P.'s San Ramon branch line track and the W.P. track, and then continue east on aerial structure through the gravel pit area, crossing numerous sidings and future El Charro Road. East of El Charro Road, the BART line would descend to grade joining the previously-described Green Line west of Murrieta Boulevard.

Yellow Line

South of Station A in Dublin, the Yellow Line would head southeast on aerial structure between the Alamo Canal and the S.P. track, crossing over Amador Valley Boulevard, Alamo Creek and Dougherty Road. South of Dougherty Road the Yellow Line would drop to the grade of the S.P. track and pass under I-580. South of the Freeway, BART would adjoin the west side of the S.P. track on aerial structure to Station F. From Station F the Yellow Line would be identical with the Red Line.

Brown Line

From Station A in Dublin to Station F in northeast Pleasanton, the Brown Line would be identical to the Yellow Line and from Station F to Station O it would be the same as the Green Line.

Orange Line

Between Station A and Amador Valley Boulevard in Dublin, the Orange Line would be the same as the Yellow Line. South of Amador Valley Boulevard, the Orange Line would turn southwest on aerial structure between the east side of the Alamo Canal and the adjacent commercial development with half of the 40-foot BART right of way inside the existing Alamo Canal right of way. The Line would cross over Dublin Boulevard and over I-580 immediately


A
San Ramon Village
1500 FEET
ONE MILE
CAMP PARKS
Dougherty
Dublin
Drive-in Theater
MIL RES
YELLOW LINE
ONE MILE
Santa Rita Rehabilitation Center (Alameda Co)
HOSPITAL
D
RED LINE
F
1500 FEET
Sewage Disposal
Pumphouses
Arroyo Mocho
Asco
Walnut Grove Sch
Gravel Pits
Amador Valley High Sch
Athletic Field
Park
Valley Trails Shopping Ctr
COUNTY FAIRGROUNDS
City Hall
Pleasanton
Alviso Adobe
Sycamore
Laguna
WESTERN PACIFIC
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SOUTHERN PACIFIC
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ONE MILE
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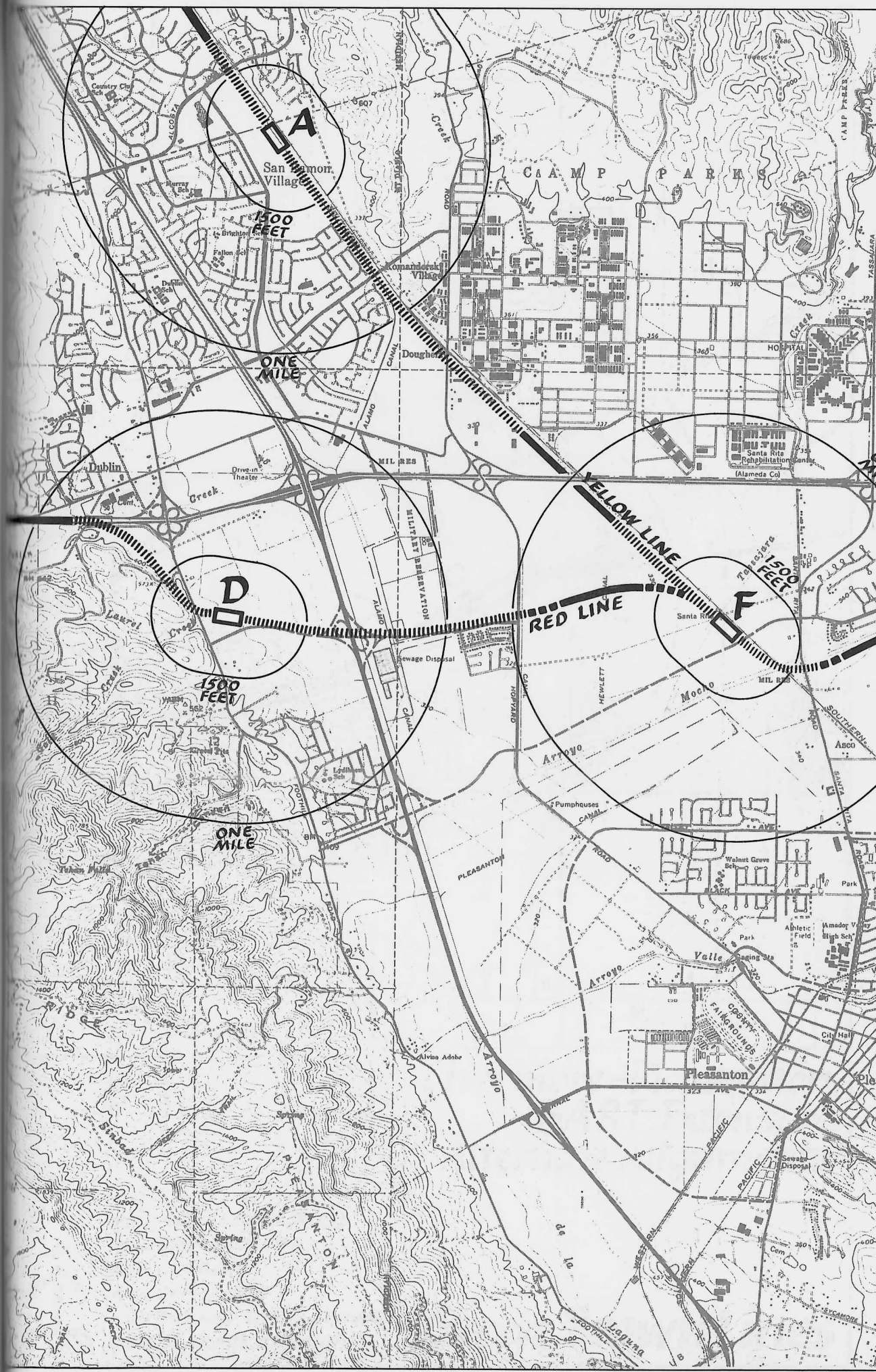


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Las Positas
Golf Course
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Cottonwood
HARTMAN
Creek
Spring
FALLON ROAD
Mocho
GRAVEL PITS
Gravel Pit
WESTERN PACIFIC
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BOULEVARD
East Pleasanton
Radum
STANLEY
Valle
VINEYARD AVENUE
EAST VINEYARD AVENUE
ALDEN LANE
LIVERMORE
Oak Knoll
Granada High Sch
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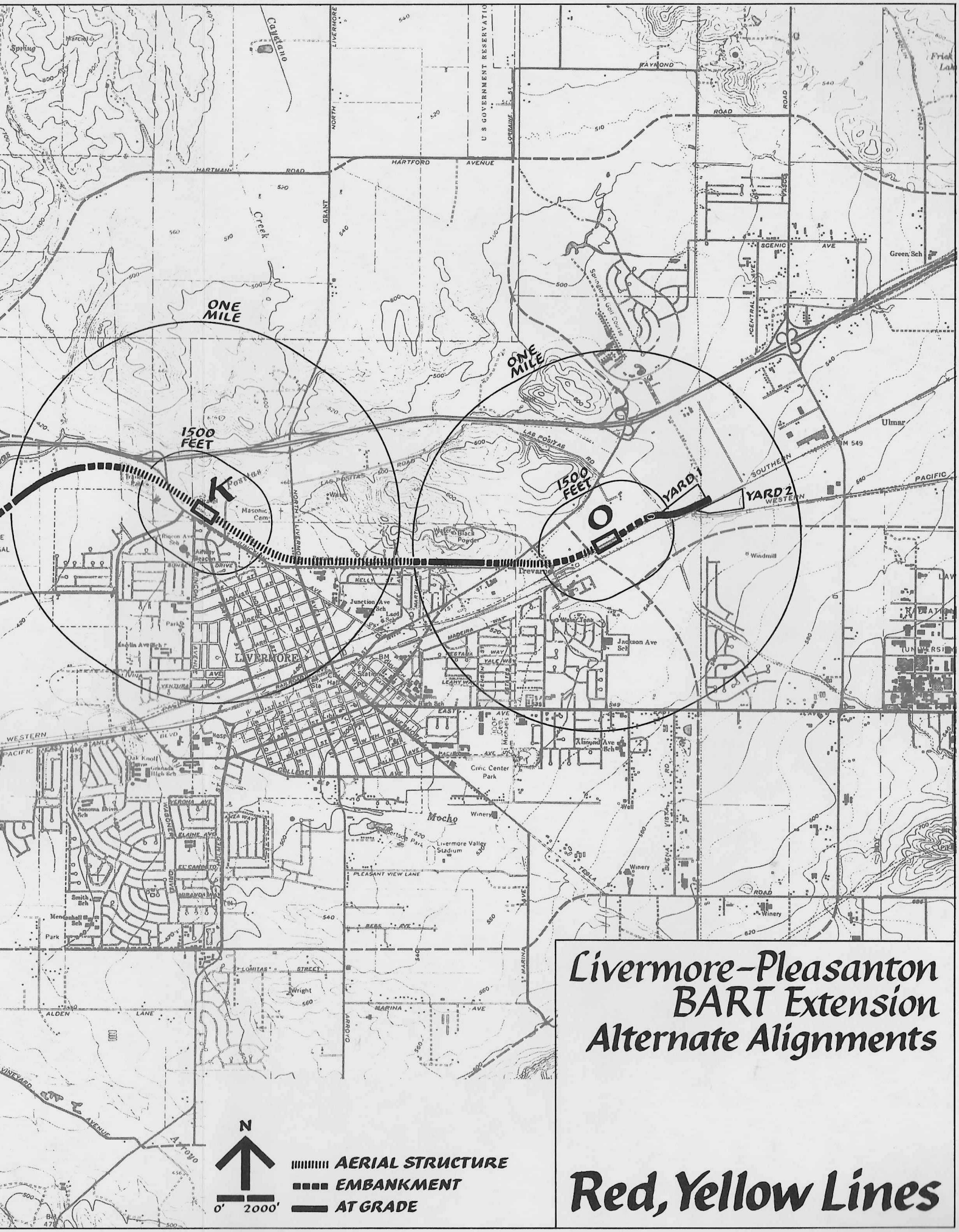
Asco
Radum
Valley
VINEYARD AVENUE
Golf Course
Cottonwood Canyon
Spring Creek
Tassajara Road
Fallon Road
Santa Rita Rehabilitation Center
Alameda Co.
Walnut Grove
Amador Valley High Sch.
Athletic Field
City Hall
Fairgrounds
Sewage Disposal
Sycamore
Laguna
Gem
Winery



Livermore-Pleasanton BART Extension Alternate Alignments

Red, Yellow Lines

YELLOW LINE
ONE MILE
1500 FEET
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Santa Rita Rehabilitation Center
(Alameda Co)
HOSPITAL
CAMP PARKS
TASSAJARA
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Spring
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Walnut Grove Sch
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Gravel Pit
Radum
STANLEY
BOULEVARD
East Pleasanton
Athletic Field
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City Hall
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VINEYARD
AVENUE
Sewage Disposal
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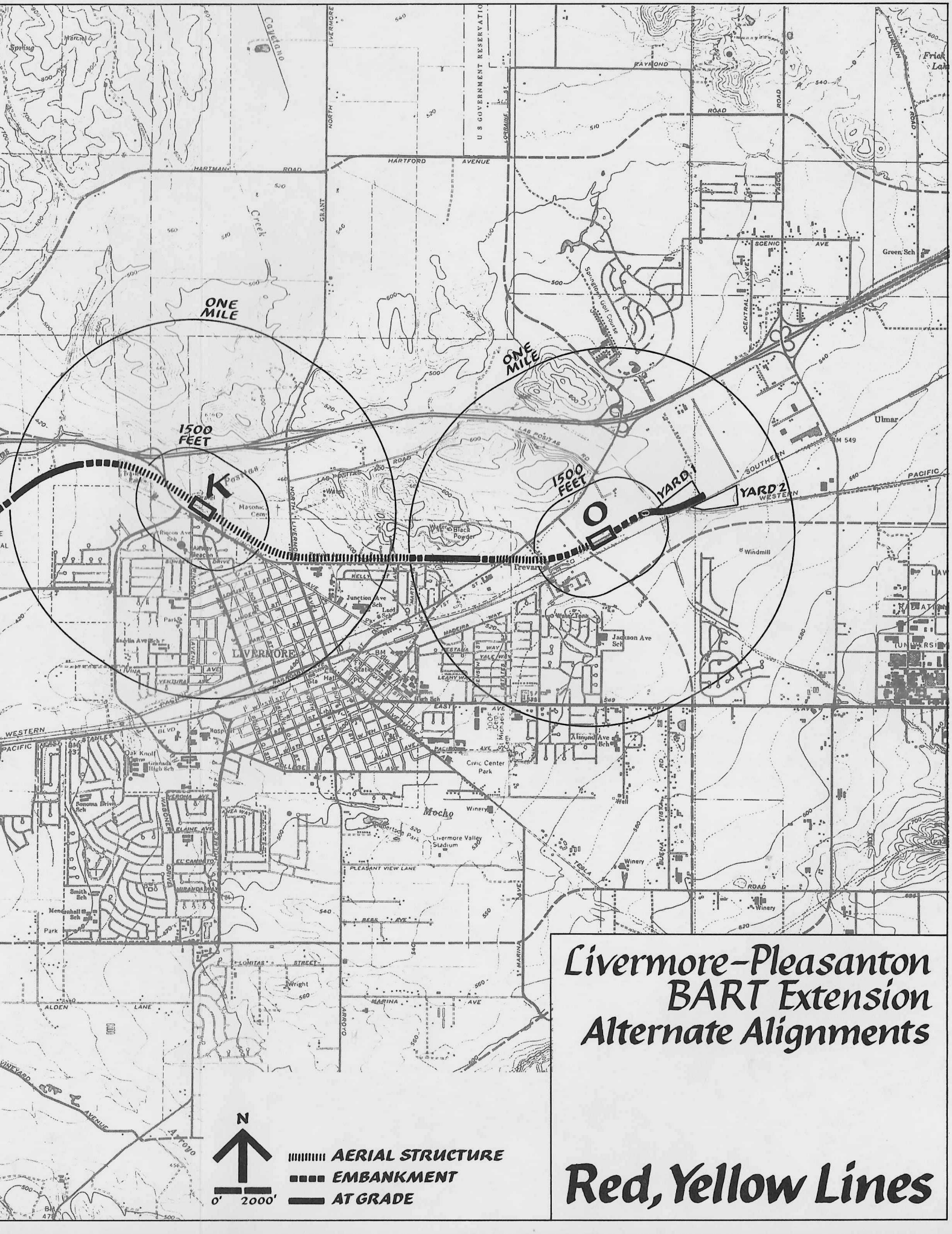
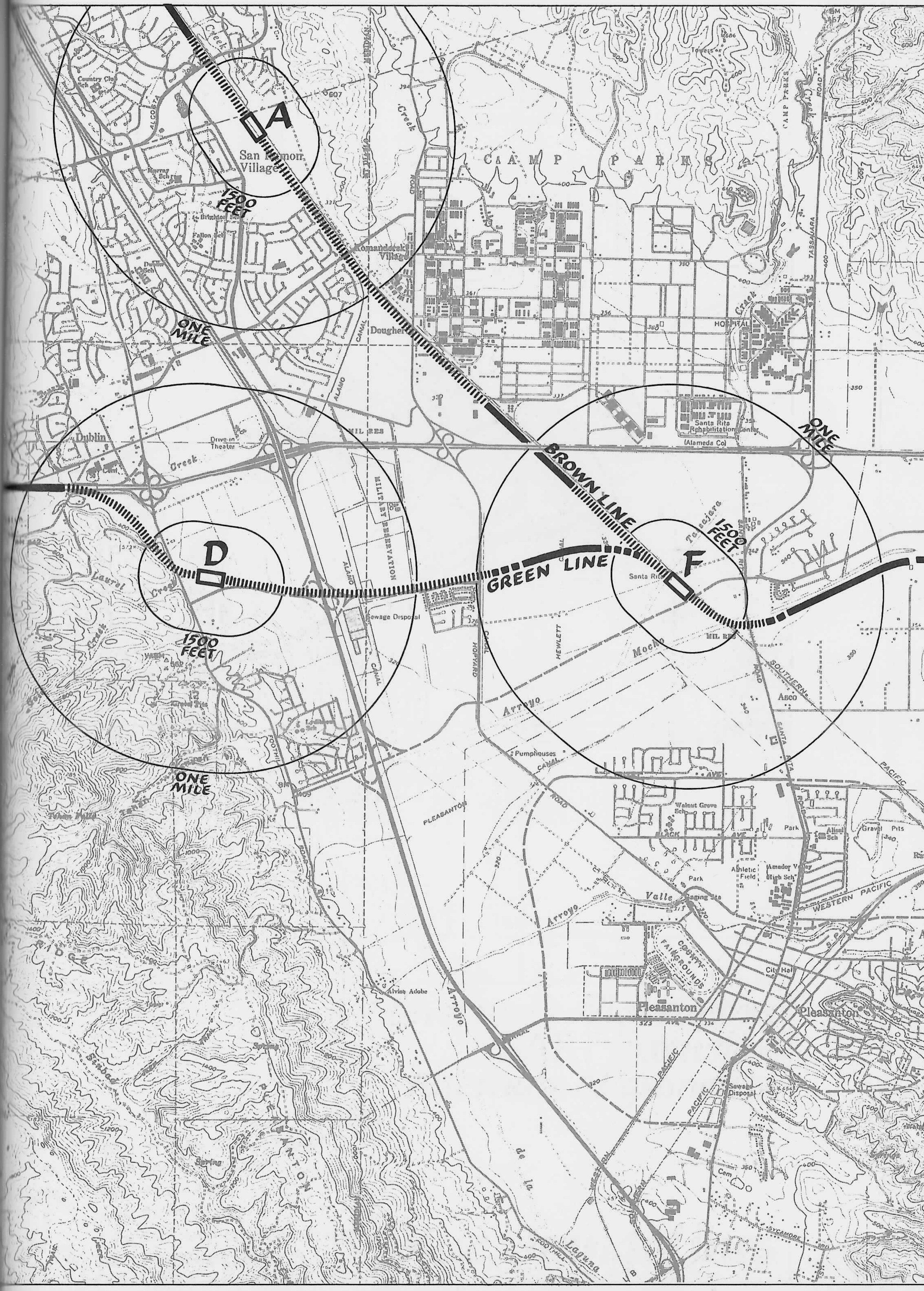


Livermore-Pleasanton BART Extension Alternate Alignments

Red, Yellow Lines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Drive-in Theater
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GREEN LINE
Laurel Creek
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Asco
Pumphouses
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Park
Athletic Field
Amador Valley High Sch
Gravel Pits
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AVENUE
SYCAMORE
Laguna

Livermore-Pleasanton BART Extension Alternate Alignments

Green, Brown Lines


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1500 FEET
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San Ramon Village
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Dublin
Drive-in Theater
ORANGE LINE
BLUE LINE
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ONE MILE
Sewage Disposal
Santa Rita
Santa Rita Rehabilitation Center
(Alameda Co)
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Mocho
Arroyo
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Tassajara
Santa Rita
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HEWLETT
Mocho
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SOUTHERN PACIFIC
Golf Course
Las Positas
Livermore Municipal Airport
Pumphouses
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City Hall
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STANLEY BOULEVARD
East Pleasanton
Gravel Pit
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Sewage Disposal
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VINEYARD AVENUE
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Laguna

Livermore-Pleasanton BART Extension Alternate Alignments

Blue, Orange Lines

east of the I-580/I-680 interchange, turn south, cross to the west side of the Alamo Canal, descend to the grade of the freeway, and continue south between I-680 and the Alamo Canal. From Station Q, the Orange Line would remain on aerial structure over Stoneridge Drive and the Alamo Canal, skirting the northwest corner of the Valley Community Services District (VCSD) Sewage Treatment Plant before returning to grade between I-680 and the Alamo Canal. From this point, the Orange Line would be the same as the Blue Line.

ALTERNATIVE VERTICAL ALIGNMENTS

Pleasanton

On the Blue and Orange Lines the basic alignment through downtown Pleasanton would be on aerial structure within the S.P. right of way and relocation of the S.P. tracks to the W.P. right of way would be optional. An at grade BART line would not be feasible because the numerous street crossings would require grade separations over or under BART and First Street, only 100 feet to the east. Costly loop ramps that would be necessary to link the grade-separated cross streets with First Street would disrupt the residential area to the east.

A more desirable, albeit considerably more expensive, alignment through Pleasanton would be underground either in cut and cover subway or in bored tunnel. Each alternative would have the same horizontal alignment as the basic aerial alignment, but a cut and cover subway could be constructed only if the S.P. tracks were relocated on the W.P. right-of-way. In the cut and cover subway alternative, BART would begin the transition from aerial structure to subway 2,000 feet west of the W.P. tracks, passing under the existing W.P. and relocated S.P. tracks west of Station J. The station location would be the same as for the basic aerial alignment, but the platform would be below ground and the mezzanine on the surface.

East of Station J, the cut and cover subway alignment would turn on a 50 mph curve, follow the S.P. right of way from Bernal Avenue extension to Ray Street, and then climb to aerial structure and cross over the Arroyo Valle and Stanley Boulevard. East of Stanley Boulevard the basic alignment of the Blue and Orange Lines would be maintained.

The bored tunnel alternative would be identical except that the BART line would be in bored tunnel under the S.P. right of way from Bernal Avenue extension to Ray Street and relocation of the S.P. tracks would be optional.

The cost of the subway and bored tunnel alternatives would be $18 million and $24 million, respectively in addition to the $27 million cost of this segment of the basic aerial alignment. The saving of $6 million afforded by the cut and cover subway alternative compared to the tunnel alternative would offset the cost of railroad relocation. With the S.P. relocated and BART underground, a major barrier in downtown Pleasanton would be removed and the S.P. right of way would be available for use as open space or for development. Pleasanton alignment alternatives are compared in Table 18.

Railroad Consolidation . The Pleasanton General Plan proposes the consolidation of the W.P. and S.P. railroad lines on the W.P. right of way to improve downtown circulation, to unify the core area, and to permit other use of the existing S.P. right of way. One alternative studied would relocate the S.P. tracks from I-680 south of Pleasanton to the Radum Wye. Estimated construction cost of this alternative is $6 million. Additional grade separations would increase the cost.

This plan eliminates two grade crossings, consolidates five other grade crossings and establishes one railroad traffic corridor, thereby reducing train-vehicle conflicts in Pleasanton. One disadvantage of this scheme is that the triangular tract of land bounded by I-680, the W.P. tracks and the relocated S.P. tracks would be isolated and difficult to develop.

A second alternative that could free this isolated tract of land would require relocation of the W.P. tracks to the right of way of the relocated S.P. tracks from Bernal Avenue to I-680 and to the existing S.P. right of way from I-680 to the W.P. overcrossing at the intersection of Verona Road and Pleasanton-Sunol Road south of Pleasanton. Substantial modifications to the I-680 overcrossing of the S.P. tracks would be necessary to accommodate the additional W.P. track under the freeway. The construction cost of this alternative is $8 million. In addition to the advantages of the first alternative, this alternative would eliminate a grade crossing at Castlewood Drive, provide access to the triangular parcel and eliminate disruption of the Castlewood golf course.

Livermore

In addition to the basic at grade alignment on the Green, Blue, Brown and Orange Lines, aerial and subway alternatives through central Livermore were studied. The horizontal alignment of the aerial alternative would be the same as the at grade alignment described as part of the Blue Line. In the subway alternative, the horizontal alignment would follow Railroad Avenue from Holmes Street to East First Street. One subway station, either Station L or Station M, would serve the downtown area.

Aerial Alternative: BART would climb to aerial structure west of Murrieta Boulevard and descend just east of the First Street/ Martin Avenue intersection, minimizing acquisition in addition to the existing W.P. right-of-way. Between Murrieta Boulevard and North "P" Street, a 3 foot easement within an existing 10 foot utility basement north of the W.P. right of way would accommodate the overhang of the aerial structure. Between North "N" Street and East First Street, about 12 feet of right-of-way north of the W.P. would be required, and further east to Station O, a strip varying from 10 to 20 feet would be needed. Compared to the basic at grade alignment between a point 2,000 feet west of Murrieta Boulevard and Station O, the additional right of way and construction cost would be $5 million, representing a premium of 15%, as shown in Table 19 Although the aerial alternative would reduce the right-of-way cost by roughly $0.7 million, the cost of the aerial structure would more than offset the saving. The aerial structure would be a greater visual intrusion and noise levels would be slightly higher than with BART at grade. However, the aerial alternative would eliminate the "barrier effect" of the fence to prevent people from crossing the at grade BART tracks.

Subway Alternative: East of Murrieta Boulevard, BART would drop below grade, pass under the existing W.P. and relocated S.P. tracks, and proceed in cut and cover subway 35 to 40 feet below grade to Subway Station L or Subway Station M.

BART would continue eastward in cut and cover subway under Railroad Avenue to a point 200 feet west of the Railroad Avenue/First Street intersection where it would pass under existing First Street and the extension of Junction Avenue and ascend to cross at grade under the planned East First Street overpass with the W.P. and relocated S.P. tracks. East of the overpass, BART would continue at grade along the south side of the relocated S.P. tracks to Estates Street where it would cross over Trevarno Road and over Mines Road extension entering Station O for the subway alternative.

Other Alternatives: Two alignment concepts through downtown Livermore were studied briefly and rejected. The first concept calling for the construction of an 80 foot wide depressed section to accommodate the relocated S.P. main line track, the existing W.P. main line and passing or future auxiliary tracks was eliminated on four counts: 1) the presence of the Arroyo Mocho west of Murrieta Boulevard, 2) the maximum allowable railroad grade of one percent, 3) drainage problems, and 4) excessive cost. The S.P. and W.P. tracks would have to bridge over the Arroyo Mocho before descending to a depressed section and could not be completely depressed until east of North "P" Street, in the center of downtown.

An alternative would be to depress the railroad tracks further west and cross under the Arroyo Mocho approximately 40 feet below grade. East of the Arroyo Mocho the relocated tracks would rise on a uniform grade until the track elevation reached 27 feet below grade at Junction Avenue. East of Junction Avenue the relocated railroad tracks would rise at a one per cent grade and join the existing W.P. track at the bridge over the S.P. tracks. The total length of this project would be approximately five miles.

Placing BART at grade above the depressed railroad tracks would necessitate the construction of overpasses over the major north-south streets instead of underpasses as currently planned. This could be avoided only by increasing the width of the depressed railroad section to accommodate a depressed BART line, thus further increasing the cost of this alternative. No public team tracks or spur tracks to serve local shippers could be provided from a depressed section. Construction would require extensive temporary track relocation for both railroads and there would be no natural drain as the tracks would be below the groundwater table. A substantial investment in high-rate pumping plants would be necessary to handle storm water and natural seepage. The disruption caused by construction of the required 80 foot wide depressed section would be quite severe and the cost would be out of scale with the financial resources of Livermore. Furthermore, it is highly unlikely that both railroads and the California Public Utilities Commission would agree to such a scheme, especially since low cost alternatives are available and may soon be implemented.

The second concept, placing BART on aerial structure over the railroad tracks, was eliminated because of severe aesthetic and accessibility problems. To maintain the required vertical and horizontal clearances to the relocated S.P. main line track and the existing W.P. main line and passing or future auxiliary tracks, the BART structure would be at least 30 feet above grade and would have an 80 foot span. The resulting high, massive structure with bulky bent-columns would be aesthetically objectionable. With BART above the railroad tracks, access to the station platform would be inconvenient. Near a station the BART alignment would have to be moved partially outside the railroad right of way to allow space for a mezzanine at one side of the railroad tracks that could connect to a platform between the BART tracks. The cost of this type of aerial structure would be substantially higher than the cost of the typical BART aerial structure.

COMPARISON OF CORRIDORS

To compare the two corridors 14 objectives are evaluated for each of the six lines. For ease of discussion the objectives are summarized in five categories: growth impact on the Valley, costs, traveler benefits, and impacts on the urban environment and the natural environment. Most of the measures of the evaluation criteria used to determine compliance of a line with an objective were presented in the Preliminary Alternatives report, although many have been refined and revised. New measures have been included for capital and operating costs based on estimates of right of way acquisition and system operating costs prepared by BART. With the delineation of the right of way requirements it was possible to count the businesses and residences displaced by each line. An estimate also was made of the total average travel time for Valley BART patrons using data developed in RTTPP Task I. In order to present the corridor measures in perspective, the evaluations are for the complete line from the existing BART system to Station O east of Livermore.

In the Valley, lines that follow the same route are paired for comparison. With the Valley segments held constant, the differences between the lines represent the differences between the corridors. The three line comparisons are Red-Yellow, Green-Brown, and Blue-Orange. For simplicity Station L is assumed on all lines through downtown Livermore.

CAPITAL COSTS

To give comparisons of traveler benefits, regional development impacts, and community impacts a common perspective, the capital costs differences among the lines are analyzed first.

Capital costs for all six lines in 1972 dollars include Consultants' estimates of the cost of construction, and BART's estimates of the cost of right of way acquisition and rolling stock. For comparison one alignment, usually the least cost alignment, is assumed for each line. The capital costs of alternative alignments in Walnut Creek are discussed separately because each of these alternates could be combined with the San Ramon Valley corridor line from Rudgear Road to Station A in Dublin.

The total capital costs for a BART extension from Bay Fair to Station O in Livermore range from a low of $235 million for the Green Line to a high of $250 million for the Blue Line. In the corridor segment there is no difference among the capital costs. For all Dublin Canyon lines the cost of right of way

TABLE 11: BART CAPITAL COSTS (1972 DOLLARS)

	Line[a.]					
	RED	GREEN	BLUE	YELLOW	BROWN	ORANGE
Length (miles)	22.5	22.8	24.1	27.5	27.3	30.0
Travel Time (minutes)	24.0	24.2	25.3	31.3	32.5	34.4
Construction Cost[b.] ($Million)	195	190	205	262	298	284
Right-of-way Cost[b.] ($Million)	16	17	17	12	15	16
Sub-Total ($Million)	211	207	222	274	313	300
Rolling Stock Cost[c.] ($Million)	28	28	28	31	31	31
Total Capital Cost[b.] ($Million)	239	235	250	305	344	331
Premium	+2%	0	+6%	+30%	+46%	+41%
Cost per Mile($Million)	10.6	10.3	10.4	11.1	12.6	11.0
Premium	+3%	0	+1%	+8%	+22%	+7%
Cost per Passenger 1980 Total Daily Trips[c.] ($ Thousand)	8.7	8.5	9.1	13.5	15.2	14.6
Premium	+2%	0	+7%	+59%	+79%	+72%

a. Basic alignment

b. Including allowance for reimbursement to CALTRANS for permitting BART to occupy freeway median

c. Based on estimated 1980 total daily trips as furnished by BART (Dublin Canyon Lines: 27,600 San Ramon Valley Lines: 22,700)

TABLE 12: BART CAPITAL COST COMPARISON OF ALTERNATIVE ALIGNMENTS IN WALNUT CREEK (FROM WALNUT CREEK STATION TO RUDGEAR ROAD)

	Alignment		
	S.P.[a.] (Yellow)	Bored Tunnel[a.,b.] (Brown)	Freeway[a.] (Orange)
Length (miles)	2.9	2.5	2.3
Travel Time (minutes)	3.8	4.7	3.2
Construction Cost[c.] ($ Million)	31	74	29
Right-Of-Way Cost[c.] ($ Million)	2	5	6
Total Capital Cost[c.,d.] ($ Million)	33	79	35
Premium	0	139%	6%
Cost Per Mile[d.] ($ Million)	11.4	31.6	15.2
Premium	0	177%	33%

a. Including a Walnut Creek Station (E, C or W)

b. Including South Walnut Creek Station at Rudgear Road

c. Including allowance for reimbursement to CALTRANS for permitting BART to occupy freeway median

d. Excluding rolling stock

ranges from $16 million to $17 million and construction cost from $190 million to $205 million. The cost of rolling stock is the same for all three Dublin Canyon lines, $28 million. The cost per mile is $10.3-$10.6 million and the cost per passenger is $8.5-$9.1 thousand, assuming a total 1980 daily patronage of 27,600 estimated by BART.

The total estimated capital cost of San Ramon Valley BART extensions ranges from a low of $305 million for the Yellow Line to a high of $344 million for the Blue Line, 30 to 46 per cent more than for the Dublin Canyon lines. Right of way costs of $12 to $16 million are comparable with Dublin Canyon lines. Rolling stock would cost $3 million more in the San Ramon corridor because more cars would be required to maintain the same headways over a greater distance. For San Ramon lines the cost per mile is 8 to 22 per cent higher than for Dublin Canyon lines and the cost per passenger is 59 to 79 per cent over the value for the Green Line. These capital cost comparisons are summarized in Table 11. Clearly, the Green Line through Dublin Canyon best complies with Objective 1, minimize BART construction and operating costs.

The capital cost comparison of alternative BART alignments in Walnut Creek, Table 12, shows the subway alignment to be more than twice as expensive as the least cost alignment along the S.P. tracks, $79 million as opposed to $33 million. At the Walnut Creek Central Station C leaseback of 3.5 acres of the 5.1 acre parcel to be acquired would generate $180,000 in annual revenues assuming leases for 200,000 square feet of office building at 10 per cent of the buildings' capitalized value (or alternatively an 8 per cent ground lease on land valued at $15 per square foot). In this way BART would benefit, in part, from the increase in land values adjoining the station area. However, the flow of lease revenue over a 25 year period would reduce the capital cost of this alternate by only $2.3 million, assuming a 6 per cent discount rate.

The capital costs of the remaining alignment alternatives in Walnut Creek along the S.P. or the freeway are quite close and would not control a decision.

BART OPERATING COSTS AND REVENUES

To estimate operating costs and revenues, it was assumed that the Blue Line and the Orange Line would be representative of the two corridors. The BART staff estimates that with a 1980 daily patronage of nearly 28,000 passenger trips (8.3 million annual) it would cost over $5.5 million per year (1972 dollars) or $0.68 per passenger trip to operate the Blue Line (see Table 13). Assuming the current fare structure of $ .30 plus $0.04 per mile over six

TABLE 13: 1980 PATRONAGE, OPERATING COSTS, REVENUES AND ROLLING STOCK REQUIREMENTS, DUBLIN CANYON CORRIDOR[a.]

Total Passenger Trips[b.]	
Daily	27,600
Annual	8,275,000
Operating Costs (1972 Dollars)	
Annual	$5,646,000
Per Passenger Trip	$ 0.68
Revenue Estimates (1972 Dollars)	
Daily	$ 34,200
Annual	$10,256,000
Per Passenger Trip	$ 1.24
Rolling Stock Requirements	
"A" Cars	23
Cost	$10,327,000
"B" Cars	46
Cost	$18,216,000
Total Cost ("A" and "B" Cars)	$28,543,000

a. Source: BART

b. Based on RTTPP, Task I, projections

TABLE 14: 1980 PATRONAGE, OPERATING COSTS, REVENUES AND ROLLING STOCK REQUIREMENTS, SAN RAMON VALLEY CORRIDOR[a.]

Total Passenger Trips[b.]	
Daily	22,700
Annual	6,798,000
Operating Costs (1972 Dollars)	
Annual	$6,651,000
Per Passenger Trip	$ 0.98
Revenue Estimates (1972 Dollars)	
Daily	$ 24,500
Annual	$7,360,000
Per Passenger Trip	$ 1.08
Rolling Stock Requirements	
"A" Cars	30
Cost	$13,470,000
"B" Cars	45
Cost	$17,820,000
Total Cost ("A" and "B" Cars)	$31,290,000

a. Source: BART

b. Based on RTTPP, Task I, projections

miles, to a maximum of $1.50, intra-Valley trips would average $0.35, trips from the Valley to Oakland would cost $1.25 and to San Francisco and beyond $1.50. Based on these fares, the revenue for the Blue Line in 1980 would be $1.24 per passenger trip.

The BART staff investigated the costs of support facilities required in conjunction with an extension to Livermore. These would include (1) new or expanded facilities in existing yards, (2) shops or maintenance of way facilities, (3) train control and communications equipment, and (4) power supply and distribution facilities. Because the magnitude of costs and the differences between the support facility requirements for the two corridors were not considered significant, they are not considered in the evaluation.

In the San Ramon Valley it would cost $6.7 million per year or $0.98 per passenger trip to operate the Orange Line. Revenue is projected at $1.08 per passenger trip. (See Table 14)

In 1980 the Dublin Canyon corridor is expected to carry 5,000 more daily passenger trips, cost $1 million per year or 30 cents per passenger trip less to operate, generate almost $3 million more annual net revenue (16 cents per passenger trip) and require six less cars at a savings of $2.8 million. These costs and revenues are summarized in Table 13.

REGIONAL DEVELOPMENT IMPACT

Initially, it had been expected that the impact of BART on Valley growth (Objective 8, Minimize Valley population growth, and Objective 9, Do not restrain Valley population growth) could be estimated using mathematical models such as PLUM. However, this was not possible because PLUM could not differentiate between BART and an eight lane freeway in making allocations based on accessibility.

A Dublin Canyon corridor BART line would have the greatest growth impact on the Valley because it would provide the greatest improvement in accessibility to San Francisco and Oakland. The case for the San Ramon corridor rests on the belief that the Valley's employment orientation could be altered to Walnut Creek and the percentage of commuter travel to Oakland and San Francisco from the Valley reduced. In this way total regional travel also would be reduced. Oakland now attracts the greatest number of Valley outcommuters. Employment gains in Walnut Creek would have to be at the expense of Oakland and, possibly, San Francisco assuming total regional employment growth will be unaffected by a decision on a BART corridor extension.

Strong arguments can be made that the goal of increasing investment and job opportunities in Oakland should have higher priority than the goal of making downtown Walnut Creek a major subregional office center. If Oakland is to be an economically healthy interracial city, it must be a convenient and accessable place to work for those who do not wish to live there. Many firm managers who make location decisions and their highly trained employees will continue to want new housing in a more homogeneous suburban social environment. Thus, a Dublin Canyon corridor extension would have a positive effect on Oakland employment by improving access from the Valley which includes much of the currently undeveloped potential residential land in Oakland's natural hinterland.

In the Valley the Dublin Canyon extension would stimulate more residential development close to stations than a San Ramon Valley line because it would attract more long distance commuters. The San Ramon Valley line would create less residential growth pressure in the Valley because it would offer poorer service to Oakland and San Francisco and because new Walnut Creek employees would have a wide choice of residential locations. Northern and eastern Contra Costa County would offer new housing at lower cost within similar commute range of Walnut Creek, particularly if a BART Pittsburg-Antioch extension is built.

TRAVELER BENEFITS

Each of the corridors under study serves different interest groups. Dublin Canyon corridor lines are best suited for long distance commuters to Oakland and San Francisco, while San Ramon Valley lines are preferable for short distance commutes to Walnut Creek, assuming sufficient jobs are created there. All trips by Valley residents to BART stations other than those on the Concord Line east of Rockridge would be faster if BART were extended through Dublin Canyon. The 15 minute travel penalty for trips to Oakland and San Francisco through Walnut Creek is a major disbenefit to those commuters. The travel time from Pleasanton to Bay Fair via conventional bus service and then to Oakland or San Francisco on BART would be the same as the travel time on BART from Pleasanton through Walnut Creek. Pleasanton commuters going to Oakland and San Francisco who want assurance of having a seat on BART would drive or take the bus to Bay Fair and transfer to BART rather than take BART to Walnut Creek where a high percentage of standees is projected on the Concord Line during peak hours.

Another measure of traveler benefits is the average total time spent travelling on BART. Assuming a constant distribution of residences and workplaces and

TABLE 15: AVERAGE TRAVEL TIME FOR VALLEY AND CORRIDOR BART WORK PATRONS BASED ON RTTPP 1980 PATRONAGE ESTIMATE

Corridor	Line	Rank	Total Patron Minutes	Average Patron Minutes
DUBLIN CANYON	Red	1	720,086	36.92
	Green	2	721,674	37.00
	Blue	3	730,410	37.45
SAN RAMON VALLEY	Yellow	4	759,795	40.14
	Brown	5	767,405	40.54
	Orange	6	779,453	41.18

TABLE 16: ESTIMATED BART TRAVEL TIMES (MINUTES)

TO \ FROM	DUBLIN CANYON CORRIDOR[b] STATION "O"	DUBLIN CANYON CORRIDOR[b] STATION "D"	SAN RAMON VALLEY CORRIDOR[c] STATION "O"	SAN RAMON VALLEY CORRIDOR[c] STATION "D"
Bay Fair	0.0 [a.]	0.0	38.0	38.0
	0.0	0.0	5.0	5.0
	25.3	11.9	34.4	21.1
	25.3	11.9	77.4	64.1
Fremont	15.0	15.0	53.0	53.0
	2.5	2.5	5.0	5.0
	25.3	11.9	34.4	21.1
	42.8	29.4	92.4	79.1
Lake Merritt	13.0	13.0	25.0	25.0
	2.5	2.5	5.0	5.0
	25.3	11.9	34.4	21.1
	40.8	27.4	64.4	51.1
City Center (12th Street-Oakland)	15.0	15.0	20.0	20.0
	4.0	4.0	5.0	5.0
	25.3	11.9	34.4	21.1
	44.3	30.9	59.4	46.1
Mac Arthur	19.0	19.0	16.0	16.0
	4.0	4.0	5.0	5.0
	25.3	11.9	34.4	21.1
	48.3	34.9	55.4	42.1
Richmond	34.0	34.0	34.0	34.0
	4.0	4.0	5.0	5.0
	25.3	11.9	34.4	21.1
	63.3	49.9	73.4	60.1
Concord	45.0	45.0	7.0	7.0
	4.0	4.0	5.0	5.0
	25.3	11.9	34.4	21.1
	74.3	60.9	46.4	33.1
Walnut Creek	38.0	38.0	0.0	0.0
	4.0	4.0	0.0	0.0
	25.3	11.9	34.4	21.1
	67.3	53.9	34.4	21.1
Rockridge	24.0	24.0	14.0	14.0
	4.0	4.0	5.0	5.0
	25.3	11.9	34.4	21.1
	53.3	39.9	53.4	40.1
Powell St. (S. F.)	26.0	26.0	31.0	31.0
	4.0	4.0	5.0	5.0
	25.3	11.9	34.4	21.1
	55.3	41.9	70.4	57.1

a. 19.0 Main Line Travel Time (From Transfer Station To Destination)
4.0 Transfer Penalty
25.3 Extension Travel Time
48.3 TOTAL TRAVEL TIME

b. "Blue" Line

c. "Orange" Line

the same propensity to ride BART in each part of the Valley, the network that minimizes total average travel time would produce the greatest traveler benefits. Using RTTPP 1, the average travel time for Valley and corridor BART work trip patrons was calculated for each BART line. Dublin Canyon lines placed first, second, and third, while San Ramon corridor lines placed fourth, fifth, and sixth. The average patron minutes for each line is presented in Table 15. These measures do not consider the assumption that Walnut Creek could become a major regional center. Total direct travel costs would be reduced most by Dublin Canyon lines even if San Ramon Valley lines had equal patronage resulting from intensive office development in Walnut Creek because San Francisco and Oakland bound patrons would save more money than Walnut Creek bound patrons. A more precise analysis of the total travel cost savings for trips diverted to BART under various network alternatives and growth assumptions must await the results of RTTPP III.

The compatibility of a BART extension with the existing system and with other potential transit service affects traveler benefits. The Dublin Canyon lines, as discussed in the section on Operations Policy, will not strain the capacity of the existing system as much as San Ramon Valley lines. Studies of the compatibility with possible future transit extensions in other corridors were based on sketch plans of transit extensions and connection configurations. The only major problems of compatibility with possible future rail extensions would occur on the Blue and Orange Lines. Stations D on the Blue Line could not become a transfer point to a future San Ramon Line. Similarly, Station Q could connect to a Dublin Canyon Line, but the configuration would be poor from an operational standpoint and very expensive.

Table 16 compares travel times in both corridors between stations at the east and west ends of the Valley and principle stations in the existing BART system.

ENVIRONMENTAL IMPACTS

Impacts on the Natural Environment

A BART line would have a major impact on the natural environment only if construction occurs outside an existing or proposed public right-of-way. Therefore, BART would have minimal impact on the natural environment in Dublin Canyon because any project to upgrade I-580 will, in all likelihood, contain an 80 foot median regardless of whether BART is built in that corridor. CALTRANS has indicated that whatever facility they would propose, be it 8 lanes, 6 lanes, or 4 lanes with a truck passing lane, would have an 80

foot median. The current proposal to widen I-580 has been tabled by the Environmental Protection Agency because it may not be "compatible with air pollution control strategies in the Valley" and not because of adverse environmental impacts on the Canyon itself. If CALTRANS were proposing to rebuild I-580 solely to accommodate BART, then the environmental impacts obviously would be attributable to BART, but this is not the case.

In the San Ramon corridor, on the other hand, any widening of I-680 as assumed in the base case to accommodate the Yellow, Brown, and Orange lines, would be at BART's request. Consequently, the responsibility for environmental impact would be borne by BART. Widening on the east side of the freeway, as proposed, would minimize disruption of improved property, but would require considerable grading and scarring of hillsides. San Ramon Valley lines are ranked lower than Dublin Canyon lines because they would have greater impact on land forms, vegetation, waterways, and wildlife. If one of the other alternate higher cost alignments described earlier that would not require widening of I-680 were chosen, the environmental impact of the corridors would have to be judged equal.

Geologic hazards were not studied in the corridors, so no specific comparisons between corridors can be made. The Dublin Canyon lines would cross two major active faults, the Hayward Fault and the Calaveras Fault, that San Ramon Valley lines would avoid, but, without detailed studies it is impossible to say that the San Ramon Valley lines are exposed to fewer geologic hazards.

The ability of a BART line to preserve open space by encouraging higher density development around stations initially was evaluated by measuring the population potential around stations within 1,500 feet and within 1 mile (2 1/2 miles in the corridors). If both measures are given equal weight, the San Ramon Valley lines come out ahead. If, however, only the population potential within 1,500 walking distance feet of Valley and corridor stations is compared, then it is a toss up. The difference between the Blue Line and the Orange Line is less than 400 people, hardly a significant number. A Castro Valley-Station D combination has almost as much potential as six stations on the Orange Line. While land costs around stations in the San Ramon Valley are lower than around Castro Valley station sites, communities there may resist high density housing. For this reason it is more likely that high density BART-oriented residential development would occur adjacent to the Castro Valley Station than around San Ramon Valley stations. Dublin Canyon lines may have greater potential to preserve open space as a result.

Impacts on the Urban Environment

Negative impacts on the urban environment would include displacement and disruption caused by BART, while the positive impacts would arise from BART induced economic and residential development. The extent to which a BART line would be compatible with the urban environment also was evaluated. Noise is not a major issue in the corridor comparison because the freeway would override BART noise when BART is in the median. When BART is outside the median, the use of barriers could reduce the impact significantly although noise would remain a problem along the S.P. alignment in the San Ramon Valley.

Displacement is a key measure in determining whether BART would cause considerable change in developed neighborhoods or create inequities. The paired line comparisons for this factor alone show mixed results, with San Ramon Valley lines coming out ahead for two out of three comparisons. The Brown Line would displace the fewest housing units (117) and the Yellow Line would displace the smallest number of businesses (7). If the alternate site for the Castro Valley Station on the west side of Redwood Road were chosen, the Green Line would displace fewer businesses and residences than the Brown Line.

Two other measures of environmental compatibility were not conclusive. Line for line, the San Ramon Valley extensions were judged slightly superior to the Dublin Canyon lines for ease of access to the station sites, but the differences are not significant. On the other hand, the visual and physical fit of San Ramon Valley lines is judged to be slightly inferior to that of Dublin Canyon lines.

The impact of BART at the point of connection to the existing system would be greater in Walnut Creek than at Bay Fair. It is likely that at least 1,900 jobs will be generated by downtown Walnut Creek stations and, conceivably, up to 13,000 new employees could be added, given a conscious public policy aimed at encouraging Walnut Creek growth. However, analysis of RTTPP 1 indicates

that more new work trips would be attracted to Bay Fair and Castro Valley with a Dublin Canyon extension than would be attracted to Walnut Creek with a San Ramon extension (using the MTC/ABAG employment projection), indicating a continuation of the greater economic interaction between the Valley and Hayward/Castro Valley than between the Valley and Walnut Creek. None-

theless, the potential for a BART extension to reinforce economic development in Walnut Creek clearly exists.

Assuming people spend a portion of any travel costs savings in local retail and service establishments, the higher Oakland and San Francisco patronage attracted by a Dublin Canyon line and resulting greater savings would cause more money to be spent in the Valley.

Summary evaluations for each of the six lines are shown in Table 17. Corridor differences are revealed by examining two paired lines that follow the same Valley route, but use different corridors: Red-Yellow, Green-Brown, and Blue-Orange.

TABLE 17: SUMMARY EVALUATIONS

Judgment Measures On An Ordinal Scale:

A--100% or exceptional; B--excellent; C--good, better than;
D--average, workable, acceptable; E--fair, less than; F--poor;
G--none.

	Scale; Unit of Measurement	Dublin Canyon Lines			San Ramon Valley Lines		
		Red	Green	Blue	Yellow	Brown	Orange
1. Objective: Minimize BART Construction and Operating Costs							
*a. Total capital cost per passenger	Ratio; thousands $	$ 8.7	$ 8.5	$ 9.1	$ 13.5	$ 15.2	$ 14.6
*b. Total capital cost	Ratio; thousands $	$239,000	$235,000	$250,000	$305,000	$344,000	$331,000
RANK		2	1	3	4	6	5
2. Objective: Maximize BART Usage							
a. Population potential within 1,500 ft. of stations	Ratio; persons	24,390	23,140	22,560	23,630	24,380	22,200
b. 1980 tributary population	Ratio; persons	87,600	96,900	97,900	136,500	132,100	155,400
c. Tributary population potential 1980-1990	Ratio; persons	27,400	17,300	16,800	68,900	76,500	62,000
e. Existing and potential employment 1972	Ratio; persons	350	1,120	1,140	4,370	6,190	4,260
within 1,500 feet of stations (1990)	Ratio; persons	(8,400)	(9,900)	(9,100)	(13,920)	(27,570)	(22,620)
*f. BART patronage projections, 1980	Ratio; total trips	27,582	27,582	27,582	22,660	22,660	22,660
*g. Average travel time for Valley BART patrons	Ratio; minutes	36.92	37.00	37.45	40.14	40.54	41.18
h. Suitability to serve young, old, poor, and disabled	Ordinal	F	F	E	F	F	E/F
RANK		3	1	2	6	4	5
4. Objective: Avoid Change in Developed Residential Neighborhoods							
a. Proximity of stations to existing development	Interval; index increases with distance	14	12	10	20	17	17
b. Propensity for change in neighborhoods near BART stations	Interval; index decreases with acreage subject to change	56	62	63	59	62	64
*c. Line displacement	Ratio; residences	147	70	70	105	89	101
	Ratio; businesses	7	11	11	6	15	16
*d. Access to station site	Ordinal	B-	C	B-	B	B-	B
*e. Station displacement	Ratio; residences	54	54	54	23	28	55
	Ratio; businesses	7	7	7	1	1	0
RANK		6	4	5	1	2	3
5. Objective: Maximize Environmental Compatibility							
a. Noise levels	Interval; index increases with linear feet of exposure	49	21	0	45	36	8
*b. Visual and physical fit	Ordinal	D	D	D	D	D-	D
c. Urban design potential	Ordinal	D	D	D	E	E	E
*e. Disturbance of land forms, vegetation, waterways, wildlife	Rank	1	1	1	2	2	2
f. Geologic hazards	Interval; index decreases with linear feet of exposure	10	9	0	22	21	29
RANK: Natural Environment		1	2	3	5	6	4
RANK: Urban Environment		1	3	5	2	4	6
6. Objective: Minimize Inequities Created by a BART Extension							
*a. Displacement by stations and routes	Ratio; residences	201	124	124	128	117	156
	Ratio; businesses	14	18	18	7	16	16
RANK		5	2	2	3	1	4
7. Objective: Preserve Maximum Open Space							
a. 1980 tributary population	Ratio; persons	24,390	23,140	22,560	23,630	24,380	22,200
b. 1990 tributary population	Ratio; persons	115,000	114,200	114,700	205,400	208,600	217,400
RANK		1	1	1	2	2	2
11. Objective: Maximize Economic Development at Point of Connection to Existing BART Line							
*a. Net change in jobs projected in 1990 within 1 mile of extension terminal	Ordinal	E	E	E	C	C	C
*b. Net change in RTTPP I projected attractions with an extension	Ratio; trips	+313	+313	+313	+74	+74	+74
*c. Development potential near extension terminal	Ordinal	E	E	E	C	C	C
RANK		2	2	2	1	1	1
13. Objective: Maximize Compatibility with Existing General Plans							
a. Degree of conflict with existing general plans	Ordinal	D	D	D	D	D-	D-
RANK		1	1	1	1	2	2
14. Objective: Maximize Compatibility with Existing BART System and with Other Potential Transit Extensions							
*a. Available capacity on existing line	Ordinal	C	C	C	E	E	E
*b. Compatibility with transfers to a bus system	Ordinal	B	B	B	C	C	B
*c. Compatibility with transfers to a rail system	Ordinal	B	B	E	C	C	D
RANK		1	2	3	5	5	4

* Primarily for corridor comparison.

COMPARISON OF VALLEY LINE SEGMENTS

CAPITAL COSTS

The capital costs for the basic alignments in the Valley are included in the total capital costs cited in the section on Comparison of Corridors. Vertical alignment alternatives in Pleasanton and Livermore could add from $5 to $35 million, but the reduction in noise and community disruption may well be worth this premium.

In downtown Pleasanton, a $24 million premium would replace the aerial structure with a cut and cover subway and relocate the S.P. tracks to the W.P. right of way. In Livermore a $5 million premium for aerial structure instead of the basic at grade alignment would displace fewer residences and businesses and remove a ground level fence preventing pedestrians from crossing BART between railroad grade separations, replacing it with more visible, if less limiting, structure. For a $17 million premium, BART could be in subway through downtown Livermore, but station access would cause more congestion than on the at grade or aerial alignments. Although a subway in Pleasanton would be more costly than in Livermore, it would remove all rails from downtown. Even with BART underground, Livermore will continue to have a major rail corridor through its center. The Livermore decisions must be based on a judgment of the cost effectiveness of removing one of three rail lines --- the quietest one, but the one carrying the most traffic and the one requiring a barrier or aerial structure. Cost details are in Tables 18 and 19.

TRAVELER BENEFITS

The Blue-Orange segment would reduce total travel in the Valley for BART commuters by half a minute (four hours per year), but the northern route would offer Pleasanton, Dublin and San Ramon patrons Station F as a convenient alternative in the event of congestion at Station D. Furthermore, the northern route has the psychological benefit of avoiding out-of-direction travel, although it would increase travel time by two minutes (16 hours per year) for the average Pleasanton rider, assumming no high density BART-oriented residential development around Station F.

TABLE 18: BART CAPITAL COST COMPARISON OF ALTERNATIVE ALIGNMENTS IN DOWNTOWN PLEASANTON (FROM BERNAL AVENUE TO RADUM WYE)

Costs	Alignment		
	Aerial	Cut and Cover Subway	Bored Tunnel
Length (miles)	2.7	2.7	2.7
Travel Time (minutes)	2.3	2.3	2.3
Construction Cost ($ Million)	26	44	50
Right-Of-Way Cost ($ Million)	1	1	1
Total Capital Cost [a.] ($ Million)	27	45	51
Premium	0	+67%	+89%
Cost Per Mile [a.] ($ Million)	10.2	17.0	19.3
Premium	0	+67%	+89%

a. Excluding rolling stock

TABLE 19: BART CAPITAL COST COMPARISON OF ALTERNATIVE ALIGNMENTS IN CENTRAL LIVERMORE (FROM 2000 FEET WEST OF MURRIETA BOULEVARD TO STATION O)

Costs	Alignment		
	At grade[a.]	Aerial[a.]	Subway[b.]
Length (miles)	3.3	3.3	3.3
Travel Time (minutes)	4.7	4.7	4.7
Construction Cost[c.] ($ Million)	30	36	49
Right-Of-Way Cost[c.] ($ Million)	3	2	1
Total Capital Cost[d.] ($ Million)	33	38	50
Premium	0	15%	52%
Cost Per Mile[d.] ($ Million)	10.0	11.5	15.2
Premium	0	15%	52%

a. Along north side of Western Pacific tracks

b. Under Railroad Avenue from Holmes Street to East First Street

c. Assuming Station L and Station O

d. Excluding rolling stock

No one line segment has a combination of stations with superior access characteristics, so this measure cannot be used to differentiate. Because the measures of traveler benefits do not show one line with a clear advantage over the others, traveler benefits probably should not be the deciding factor in choosing between the northern and southern lines.

IMPACT ON URBAN ENVIRONMENT

Noise

In the Preliminary Alternatives report an evaluation of BART's noise impact was made based on the length of line frontage exposed to BART noise. Subsequent studies of noise impacts have been made using field measurements of BART noise made by Wilson Ihrig and Associates for BART and by the City of Albany to develop noise contours showing the mean maximum level of sound propagated by 8 to 10 car BART trains in actual operation on each type of structure in relation to distance from BART tracks.

Using noise standards developed by the National Cooperative Highway Research Program, measures of exposures of existing and projected 1990 land uses to moderate noise impact (0 to 5 dbA above the standard) and major noise impact (over 5 dbA above) were computed. The standards are 75 dbA for commercial land use, 70 dbA for parks and schools, and 65 dbA for residential land use. For each line a composite index on a 0 to 100 scale was computed assuming major impacts to have twice the weight of moderate impacts. Obviously, all lines create noise in urban areas, so no line had a composite index of 100.

The Red Line would expose the fewest people to BART noise, while the Blue Line would expose the most. However, if the subway alternative in Pleasanton and/or in Livermore were chosen, the Brown and Blue Lines would be better than the Red Line. Barriers, such as have been installed near the North Berkeley Station, could be used along at grade and aerial sections of a line to reduce noise, but even then, housing within 300 feet of a BART line would be exposed to moderate noise impact, and housing within 125 feet would suffer major impact. Table 20 summarizes the noise impact assessment for all six lines.

Disruption and Displacement

All of the displacement and the bulk of the disruption would occur in Livermore. Along the Red-Yellow Line 70 mobile homes, 24 single family houses,

TABLE 20: NOISE IMPACT ASSESSMENT

Line	Rank	Composite Index	Existing 1972 Land Use[a.] Moderate Impact 0-5dGA	Existing 1972 Land Use[a.] Major Impact Over 5dGA	Projected 1990 Land Use[a.] Moderate Impact 0-5dGA	Projected 1990 Land Use[a.] Major Impact Over 5dGA
RED	1	49	3,300	19,000	7,000	53,000
GREEN	4	21	8,000	22,800	5,800	53,900
(with subway)		(46)	(3,000)	(15,500)	(5,800)	(39,300)
BLUE	6	0	8,500	35,900	7,000	63,500
(with subway)		(55)	(3,500)	(18,000)	(6,000)	(37,900)
YELLOW	2	45	2,900	18,100	2,200	50,700
BROWN	3	36	7,600	21,900	1,000	51,600
(with subway)		(60)	(2,600)	(14,600)	(1,000)	(37,000)
ORANGE	5	8	7,400	38,800	2,900	67,600
(with subway)		(50)	(2,400)	(21,000)	(1,900)	(42,000)

a. Linear feet of land use adjacent to alignment

and 6 businesses employing approximately 30 people would have to be acquired, and the households and firms relocated. Of the three alignment alternatives through downtown Livermore, the subway is least disruptive, displacing only four businesses employing approximately 14 people. An aerial alignment would displace one single family house and one multi-family house in addition to four businesses. The at grade alignment, assumed as the base case, displaces 13 single family houses, 4 multi-family houses and 10 businesses with approximately 65 employees. Station displacement is described in the Valley Stations section.

Visual and Physical Fit; Urban Design Potential

Judgment measures for each station and line segment are in the six tables of summary line evaluations. Aerial structures would offer stimulating views for BART riders, but they would be out of scale with nearby residential development which should receive first consideration. Where new high density housing would adjoin an aerial station, site plans that locate parking near BART and orient living areas away from it can minimize the problem.

Local Government Costs

A detailed analysis of the impact of BART alternatives on local government costs is far beyond the scope of this study, and would require so many assumptions about future development patterns as to be highly vulnerable to challenge. Instead, a more modest approach using three surrogate measures is used: land used by BART, total travel, and amount of land urbanized.

The BART alternate requiring the least land outside existing public rights of way would leave the most land available for whatever uses the local communities decided are socially or economically beneficial. In other words, the line that can make joint use of land already in use but not available for other new uses is superior. The following comparisons are not based on assumptions about the development potential of land that would not be acquired.

The four northern Valley routes take over 100 acres of private land and only 6 to 11 acres of public land. The Blue-Orange Line segment, on the other hand, requires 35 acres of public land and only 59 acres of private land. So the southern routes require the least land and also leave 45 acres more in private ownership. Whether this would result in lower government costs could only be determined after a detailed market study of alternative uses to

which the land not acquired could be put and the shift that would occur in total land use allocation within the taxing jurisdiction. Assuming, for the moment that a correlation between land use efficiency and lower government costs is valid, the southern routes are preferable to the northern routes.

Assuming the same patronage on a northern or southern Valley line, the amount of travel on local streets to reach BART stations affects street construction and maintenance costs and local transit mileage. The southern routes require less travel to stations and should minimize local costs for streets, bikeways, and feeder bus service.

Other studies have shown that compaction of residential development brings significant savings in utilities and street construction and maintenance costs, which vary within a fairly narrow range per square mile of urban area served. Higher densities are more economical and BART would encourage compaction, but opportunities for high density BART-oriented housing exist on all Valley line segments, so the evidence does not present a strong case for one line over another on this point. Analysis of costs to expand and improve an existing street and utilities system to service higher densities in a presently built-up area vs. the costs of initial construction for high densities at an outlying site might show significant differences.

Historical Sites

The only historical sites that would be directly affected by BART construction in the Valley are near Station K. The Alexander Eden home, built in the 1850's and still in good condition, might have to be moved to accommodate the Red-Yellow Line segment west of Station K. Station K also would cover the site of the Livermore Adobe, which no longer is intact. Archaelogical work could be done during BART construction. No state or national historical land marks would be directly or indirectly affected by a BART extension.

IMPACT ON NATURAL ENVIRONMENT

Geologic Factors

Four basic geologic factors must be considered in determining the best route for BART. Slope stability and faults are geologic hazards that affect public safety, while expansive soils and locally high water tables are geologic problems that can affect construction costs.

Faults Within the Livermore-Pleasanton area there are two fault zones that are known to be active and several others that must be considered potentially active, although the amount of activity is unknown. The Calaveras Fault, which runs along the west edge of the Valley, is a major tectonic structure that is known to be active and capable of producing a maximum credible earthquake magnitude $7\frac{1}{2}$ (Richter Scale). The Pleasanton Fault zone, east of the Calaveras Fault, and sub-parallel to it, consists of several branches that first were located as groundwater barriers. The Pleasanton Fault is believed to be undergoing tectonic creep currently.

Potentially active faults include the Parks Fault which trends in an east-west direction oblique to the other faults within the area. It is known only as a groundwater barrier with no surface expression reported. Its present activity is unknown but it does offset the Plio-Pleistocene alluvium. The Livermore Fault zone trends northwest just west of Livermore and is exposed in a landslide scarp on the east side of Oak Knoll. The remainder of the fault's several branches are known only as groundwater barriers. The Mocho Fault has been mapped just to the east of the Livermore Fault zone. Very little is known about this fault and its existence is questionable. Because there is no surface expression of the faults within the Valley, a more detailed study of the faults should be made prior to constructing a BART extension in order to determine their exact location.

The least hazardous design for crossing faults is to have the roadbed at grade and at a right angle to the fault trace. If subway construction is necessary at a fault crossing, special design considerations, such as increased subway width, should be considered. Fault crossings on elevated structures represent the greatest hazard of the three alternatives because of the possibility of collapse of the structure.

Slope Stability A 2,000 foot length of the Blue and Orange Lines would pass between two large gravel pits east of Pleasanton. If this route is selected, detailed engineering studies would be required to determine the stability of the pit cutslopes adjacent to the line. The study should be directed toward assessing behavior of the slopes under both static and earthquake loading conditions. This potential hazard might be compounded further by the elevated structure along the gravel pits. At the current level of geologic study the northern lines are ranked superior to the southern lines for slope stability.

Expansive Soils Expansive soils provide poor foundation for engineering works and require special design and construction measures, particularly for at grade track. The expansiveness of the soil is determined by the type and amount of

TABLE 21: EXPOSURE OF VALLEY LINES TO FAULTS OR GEOLOGIC HAZARDS BY STRUCTURE TYPE

Line	Rank	Composite Index	Linear Feet by Structure Type		
			Aerial	At grade	Embankment
Red	4	10	6,000	1,300	5,100
Green	5	9	5,500	4,800	2,300
Blue	6	0	8,000	5,800	0
Yellow	2	22	4,300	2,600	3,900
Brown	3	21	3,700	6,100	1,100
Orange	1	29	4,000	5,800	0

Source: Geologic studies by Woodward-Lundgren and Associates, Consulting Engineers and Geologists.

clay present in the soil, and this can change with depth. In the western and northern portions of the Valley there is as much as 70 feet of clay overlying the gravels. The clay layer becomes sandier and thinner to the southeast. Some of these clays are locally very corrosive, and this would need to be considered in design and construction.

High Water Table Some of the soil units within the Valley contain high or perched water tables, expecially during the wet season. Except where the water table is at the surface, this would be a problem only in subway portions of the selected route.

Neither high water table nor expansive soils are serious environmental constraints and, therefore, are not included in the evaluation of geologic hazards to determine compliance with the objective: Maximize environmental compatability.

For each of the six Valley lines the lineal feet of line subject to geologic hazards of fault crossing or landslide were measured. An average of 11,800 feet of line would be exposed to these geologic hazards, but the differences are not significant. The Orange Line would have the least exposure, 9,800 feet, while the Blue Line would have the most, 13,800 feet. Table 21 summarizes these measures.

Disruption

None of the Valley line segments would cause significant alteration of natural land forms. Because the northern lines traverse agricultural and vacant land, they would cause alteration of drainage patterns and would affect agricultural operations and existing flora and fauna. However, most of the affected area is expected to be urbanized whether BART is extended or not.

Recreation Trails

All BART lines in the Valley would have an effect on the existing and planned recreation trail system by offering additional opportunities for joint right of way use. Recreation trails for bicycling, hiking, and horseback riding running parallel to BART aerial structure could benefit from the enlarged right of way. With BART at grade it still would be possible to have trails for bicycling or hiking alongside, but BART noise probably would make a horseback riding tail undesirable. Trail crossings could be designed into the system quite easily. Currently, six to eight miles of existing or planned trails in the Valley would be alongside potential BART lines. Many creeks and arroyos could be developed with linear parks and bikeways connecting to the stations.

SUMMARY EVALUATION OF SIX LINES

All of the impacts and measures of compliance with the evaluation criteria have been brought together in a systematic way in the six tables that follow. For each objective, the specific measures for stations, links in the Valley, and corridors are presented. The lines have been ranked for their compliance with each of the planning objectives. This method of summarizing the results of the evaluation process does not obscure important differences among the lines that would result from presenting only summary rankings. Any reader who does not agree with the rankings assigned and the relative weight accorded criteria and objectives, can assign new rankings based on different weighting and evaluate the outcome.

Three value scales are used in the tables. An ordinal scale, A to G, is used to rank stations or links according to judgments about urban design potential, compatibility with existing general plans, or other factors that are hard to quantify. An interval scale is used to define the order and relative magnitude of difference between data items with an arbitrary origin. Examples are distance from a BART line to existing development or the acreage subject to land use change if a particular link or station were built. Use of a non-arbitrary origin transforms this scale into a ratio scale measuring units such as time, money, and people served.

Because the objective of this report is to present the findings of the evaluation process, an overall ranking of the lines is not shown. The trade-off between higher costs and less noise, for instance, is a matter of individual values and expectations about future transit financing and technology.

The public hearings are for the purpose of receiving the evaluations of affected citizens and local public officials. The consultants then will recommend a route to the Board, taking account of information and viewpoints presented at the hearings.

RED LINE EVALUATION (Dublin Canyon Corridor 22.5 Miles)

Judgment Measures On An Ordinal Scale:

A--100% or exceptional; B--excellent; C--good, better than; D--average, workable, acceptable; E--fair, less than; F--poor; G--none.

	Scale; Unit of Measurement	Total Summary	Link	Castro Valley Station CV	Link	Pleasanton Station D	Link	Pleasanton Station F	Link	Livermore Station K	Link	Livermore Station O
1. Objective: Minimize BART Construction and Operating Costs												
b. Total capital cost	Ratio; million $	239										
2. Objective: Maximize BART Usage												
a. Population potential within 1,500 ft. of stations	Ratio; persons	24,390		4,200		2,660		4,680		5,350		7,500
b. Population 1980 within 1 mile service area from stations	Ratio; persons	87,600		46,300[a]		7,300		8,400		14,400		11,200
c. Population potential within 1 mile service area from stations in addition to Criterion b	Ratio; persons	27,400		6,100[b]		4,500		2,800		10,800		3,200
d. Accessibility of stations to 1980 population within 8 minutes driving time	Ratio; index = population ÷ driving time to station	42		n.a.		39		24		85		20
e. Existing and potential employment 1972	Ratio; persons	350		300		0		0		30		20
within 1,500 feet of stations (1990)	Ratio; persons	(8,400)		(500)		(4,000)		(1,800)		(100)		(2,000)
f. BART patronage projections, 1980	Ratio; total trips	27,582										
g. Average travel time for Valley BART patrons	Ratio; minutes	36.92										
h. Suitability to serve young, old, poor, and disabled	Ordinal			E		G		G		E		F
4. Objective: Avoid Change in Developed Residential Neighborhoods												
a. Proximity of stations to existing development	Interval; index increases with distance	14		0		10		14		6		38
b. Propensity for change in neighborhoods near BART stations	Interval; index decreases with acreage subject to change	56		0		63		95		22		98
c. Line displacement	Ratio; residences	147	53		0		0		70		24	
	Ratio; businesses	7	1		0		0		2		4	
d. Access to station site	Ordinal			D		D		B		A		B
e. Station displacement	Ratio; residences	54		54		0		0		0		0
	Ratio; businesses	7		7		0		0		0		0
5. Objective: Maximize Environmental Compatibility												
a. Noise levels	Ordinal; rank based on linear feet		B		B		A		D		C	
b. Visual and physical fit	Ordinal		D	C	D	C	E	E	C	C	D	E
c. Urban design potential	Ordinal			B		C		C		E		F
6. Objective: Minimize Inequities Created by a BART Extension												
a. Displacement by stations and routes	Ratio; residences	201	53	54	0	0	0	0	70	0	24	0
	Ratio; businesses	14	1	7	0	0	0	0	2	0	4	0
7. Objective: Preserve Maximum Open Space												
a. Population potential within 1,500 ft. of stations	Ratio; persons	24,390		4,200		2,660		4,680		5,350		7,500
b. Population potential within 1 mile service area from stations	Ratio; persons	115,000		52,400[b]		11,800		11,200		25,200		14,400
11. Objective: Maximize Economic Development at Point of Connection to Existing BART Line												
a. Net change in jobs projected in 1990 within 1 mile of extension terminal	Ordinal	E										
b. Net change in RTTPP I projected attractions with an extension	Ratio; trips	+313										
c. Development potential near extension terminal	Ordinal	E										
13. Objective: Maximize Compatibility with Existing General Plans												
a. Degree of conflict with existing general plans	Ordinal			E		D		D		D		D
14. Objective: Maximize Compatibility with Existing BART System and with Other Potential Transit Extensions												
a. Available capacity on existing line	Ordinal	C										
b. Compatibility with transfers to a bus system	Ordinal	A										
c. Compatibility with transfers to a rail system	Ordinal	D										

[a] 1980 tributary population (approximately 2-1/2 miles).

[b] 1990 tributary population (approximately 2-1/2 miles).

GREEN LINE EVALUATION (Dublin Canyon Corridor 22.8 Miles)

Judgment Measures On An Ordinal Scale:

A--100% or exceptional; B--excellent; C--good, better than;
D--average, workable, acceptable; E--fair, less than; F--poor;
G--none.

	Scale; Unit of Measurement	Total Summary	Link	Castro Valley Station CV	Link	Pleasanton Station D	Link	Pleasanton Station F	Link	Livermore Station L	Link	Livermore Station O
1. Objective: Minimize BART Construction and Operating Costs												
b. Total capital cost	Ratio; million $	235										
2. Objective: Maximize BART Usage												
a. Population potential within 1,500 ft. of stations	Ratio; persons	23,140		4,200		2,660		4,680		4,100		7,500
b. Population 1980 within 1 mile service area from stations	Ratio; persons	96,900		46,300[a]		7,300		8,400		23,700		11,200
c. Population potential within 1 mile service area from stations in addition to Criterion b	Ratio; persons	17,300		6,100[b]		4,500		2,800		700		3,200
d. Accessibility of stations to 1980 population within 8 minutes driving time	Ratio; index = population ÷ driving time to station	44		n.a.		39		24		93		20
e. Existing and potential employment 1972	Ratio; persons	1,120		300		0		0		800		20
within 1,500 feet of stations (1990)	Ratio; persons	(9,900)		(500)		(4,000)		(1,800)		(1,600)		(2,000)
f. BART patronage projections, 1980	Ratio; total trips	27,582										
g. Average travel time for Valley BART patrons	Ratio; minutes	37.00										
h. Suitability to serve young, old, poor, and disabled	Ordinal			E		G		G		D		F
4. Objective: Avoid Change in Developed Residential Neighborhoods												
a. Proximity of stations to existing development	Interval; index increases with distance	12		0		10		14		0		38
b. Propensity for change in neighborhoods near BART stations	Interval; index decreases with acreage subject to change	62		0		63		95		56		98
c. Line displacement	Ratio; residences	70	53		0		0		0		17	
	Ratio; businesses	11	1		0		0		0		10	
d. Access to station site	Ordinal			D		D		B		B		B
e. Station displacement	Ratio; residences	54		54		0		0		0		0
	Ratio; businesses	7		7		0		0		0		0
5. Objective: Maximize Environmental Compatibility												
a. Noise levels	Ordinal; rank based on linear feet		B		B		B		B		B	
b. Visual and physical fit	Ordinal		D	C	D	C	C	E	D	D	E	F
c. Urban design potential	Ordinal			B		C		C		D		F
6. Objective: Minimize Inequities Created by a BART Extension												
a. Displacement by stations and routes	Ratio; residences	124	53	54	0	0	0	0	0	0	17	0
	Ratio; businesses	18	1	7	0	0	0	0	0	0	10	0
7. Objective: Preserve Maximum Open Space												
a. Population potential within 1,500 ft. of stations	Ratio; persons	23,140		4,200		2,660		4,680		4,100		7,500
b. Population potential within 1 mile service area from stations	Ratio; persons	114,200		52,400[b]		11,800		11,200		24,400		14,400
11. Objective: Maximize Economic Development at Point of Connection to Existing BART Line												
a. Net change in jobs projected in 1990 within 1 mile of extension terminal	Ordinal	E										
b. Net change in RTTPP I projected attractions with an extension	Ratio; trips	+313										
c. Development potential near extension terminal	Ordinal	E										
13. Objective: Maximize Compatibility with Existing General Plans												
a. Degree of conflict with existing general plans	Ordinal			E		D		D		E		D
14. Objective: Maximize Compatibility with Existing BART System and with Other Potential Transit Extensions												
a. Available capacity on existing line	Ordinal	C										
b. Compatibility with transfers to a bus system	Ordinal	C										
c. Compatibility with transfers to a rail system	Ordinal	B										

[a] 1980 tributary population (approximately 2-1/2 miles).

[b] 1990 tributary population (approximately 2-1/2 miles).

BLUE LINE EVALUATION (Dublin Canyon Corridor 24.1 Miles)

Judgment Measures On An Ordinal Scale:

A--100% or exceptional; B--excellent; C--good, better than;
D--average, workable, acceptable; E--fair, less than; F--poor;
G--none.

	Scale; Unit of Measurement	Total Summary	Link	Castro Valley Station CV	Link	Pleasanton Station D	Link	Pleasanton Station J	Link	Livermore Station L	Link	Livermore Station O
1. Objective: Minimize BART Construction and Operating Costs												
b. Total capital cost	Ratio; million $	250										
2. Objective: Maximize BART Usage												
a. Population potential within 1,500 ft. of stations	Ratio; persons	22,560		4,200		2,660		4,100		4,100		7,500
b. Population 1980 within 1 mile service area from stations	Ratio; persons	97,900		46,300[a]		7,300		9,400		23,700		11,200
c. Population potential within 1 mile service area from stations in addition to Criterion b	Ratio; persons	16,800		6,100[b]		4,500		2,300		700		3,200
d. Accessibility of stations to 1980 population within 8 minutes driving time	Ratio; index = population ÷ driving time to station	54		n.a.		39		63		93		20
e. Existing and potential employment 1972	Ratio; persons	1,140		300		0		20		800		20
within 1,500 feet of stations (1990)	Ratio; persons	(9,100)		(500)		(4,000)		(1,000)		(1,600)		(2,000)
f. BART patronage projections, 1980	Ratio; total trips	27,582										
g. Average travel time for Valley BART patrons	Ratio; minutes	37.45										
h. Suitability to serve young, old, poor, and disabled	Ordinal			E		G		D		D		F
4. Objective: Avoid Change in Developed Residential Neighborhoods												
a. Proximity of stations to existing development	Interval; index increases with distance	10		0		10		0		0		38
b. Propensity for change in neighborhoods near BART stations	Interval; index decreases with acreage subject to change	63		0		63		97		56		98
c. Line displacement	Ratio; residences	70	53		0		0		0		17	
	Ratio; businesses	11	1		0		0		0		10	
d. Access to station site	Ordinal			D		D		A		B		B
e. Station displacement	Ratio; residences	54		54		0		0		0		0
	Ratio; businesses	7		7		0		0		0		0
5. Objective: Maximize Environmental Compatibility												
a. Noise levels	Ordinal; rank based on linear feet		B		B		B		D		B	
b. Visual and physical fit	Ordinal		D	C	D	C	C	D	E	D	E	E
c. Urban design potential	Ordinal			B		C		D		D		F
6. Objective: Minimize Inequities Created by a BART Extension												
a. Displacement by stations and routes	Ratio; residences	124	53	54	0	0	0	0	0	0	17	0
	Ratio; businesses	18	1	7	0	0	0	0	0	0	10	0
7. Objective: Preserve Maximum Open Space												
a. Population potential within 1,500 ft. of stations	Ratio; persons	22,560		4,200		2,660		4,100		4,100		7,500
b. Population potential within 1 mile service area from stations	Ratio; persons	114,700		52,400[b]		11,800		11,700		24,400		14,400
11. Objective: Maximize Economic Development at Point of Connection to Existing BART Line												
a. Net change in jobs projected in 1990 within 1 mile of extension terminal	Ordinal	E										
b. Net change in RTTPP I projected attractions with an extension	Ratio; trips	+313										
c. Development potential near extension terminal	Ordinal	E										
13. Objective: Maximize Compatibility with Existing General Plans												
a. Degree of conflict with existing general plans	Ordinal			E		D		D		E		D
14. Objective: Maximize Compatibility with Existing BART System and with Other Potential Transit Extensions												
a. Available capacity on existing line	Ordinal	C										
b. Compatibility with transfers to a bus system	Ordinal	D										
c. Compatibility with transfers to a rail system	Ordinal	D										

[a] 1980 tributary population (approximately 2-1/2 miles).

[b] 1990 tributary population (approximately 2-1/2 miles).

YELLOW LINE EVALUATION (San Ramon Corridor 27.5 Miles)

Judgment Measures On An Ordinal Scale:

A--100% or exceptional; B--excellent; C--good, better than; D--average, workable, acceptable; E--fair, less than; F--poor; G--none.

	Scale; Unit of Measurement	Total Summary	Link	Walnut Creek Station E	Link	Livorna Road Station	Link	Danville Station	Link	San Ramon Station	Link	Dublin Station A	Link	Pleasanton Station F	Link	Livermore Station K	Link	Livermore Station O
1. Objective: Minimize BART Construction and Operating Costs																		
b. Total capital cost	Ratio; million $	305																
2. Objective: Maximize BART Usage																		
a. Population potential within 1,500 ft. of stations	Ratio; persons	23,630		2,000		200		2,100		500		1,300		4,680		5,350		7,500
b. Population 1980 within 1 mile service area from stations	Ratio; persons	136,500		24,000[a]		31,000[a]		16,000[a]		11,500[a]		20,000		8,400		14,400		11,200
c. Population potential within 1 mile service area from stations in addition to Criterion b	Ratio; persons	68,900		8,700[b]		16,400[b]		20,100[b]		3,400[b]		3,500		2,800		10,800		3,200
d. Accessibility of stations to 1980 population within 8 minutes driving time	Ratio; index = population ÷ driving time to station	43		n.a.		n.a.		n.a.		n.a.		n.a.		24		85		20
e. Existing and potential employment 1972	Ratio; persons	4,370		4,000		0		20		200		100		0		30		20
within 1,500 feet of stations (1990)	Ratio; persons	(13,920)		(9,650)		(0)		(20)		(2,000)		(150)		(1,800)		(100)		(200)
f. BART patronage projections, 1980	Ratio; total trips	22,660																
g. Average travel time for Valley BART patrons	Ratio; minutes	40.14																
h. Suitability to serve young, old, poor, and disabled	Ordinal			D		G		G		F		E		G		E		F
4. Objective: Avoid Change in Developed Residential Neighborhoods																		
a. Proximity of stations to existing development	Interval; index increases with distance	20		0		0		0		100		0		14		6		38
b. Propensity for change in neighborhoods near BART stations	Interval; index decreases with acreage subject to change	59		98		39		3		66		53		95		22		98
c. Line displacement	Ratio; residences	105	0		11		0		0		0		0		70		24	
	Ratio; businesses	6	0		0		0		0		0		0		2		4	
d. Access to station site	Ordinal			C		D		C		B		B		B		A		B
e. Station displacement	Ratio; residences	23		0		0		23		0		0		0		0		0
	Ratio; businesses	1		1		0		0		0		0		0		0		0
5. Objective: Maximize Environmental Compatibility																		
a. Noise levels	Ordinal; rank based on linear feet		F		E		A		D		F		F		D		C	
b. Visual and physical fit	Ordinal		D	D	E	E	E	D	D	D	C	D	C	E	C	C	D	E
c. Urban design potential	Ordinal			D		E		E		E		E		C		B		F
6. Objective: Minimize Inequities Created by a BART Extension																		
a. Displacement by stations and routes	Ratio; residences	128	0	0	11	0	0	23	0	0	0	0	0	0	70	0	24	0
	Ratio; businesses	7	0	1	0	0	0	0	0	0	0	0	0	0	2	0	4	0
7. Objective: Preserve Maximum Open Space																		
a. Population potential within 1,500 ft. of stations	Ratio; persons	23,630		2,000		200		2,100		500		1,300		4,680		5,350		7,500
b. Population potential within 1 mile service area from stations	Ratio; persons	205,400		32,700[b]		47,700[b]		36,100[b]		14,900[b]		23,500		11,200		25,200		14,400
11. Objective: Maximize Economic Development at Point of Connection to Existing BART Line																		
a. Net change in jobs projected in 1990 within 1 mile of extension terminal	Ordinal	C																
b. Net change in RTPP I projected attractions with an extension	Ratio; trips	+74																
c. Development potential near extension terminal	Ordinal	C																
13. Objective: Maximize Compatibility with Existing General Plans																		
a. Degree of conflict with existing general plans	Ordinal			D		E		E		D		D		D		D		D
14. Objective: Maximize Compatibility with Existing BART System and with Other Potential Transit Extensions																		
a. Available capacity on existing line	Ordinal	E																
b. Compatibility with transfers to a bus system	Ordinal	C																
c. Compatibility with transfers to a rail system	Ordinal	B																

[a] 1980 tributary population (approximately 2-1/2 miles).

[b] 1990 tributary population (approximately 2-1/2 miles).

BROWN LINE EVALUATION (San Ramon Corridor 27.3 Miles)

Judgment Measures On An Ordinal Scale:

A--100% or exceptional; B--excellent; C--good, better than; D--average, workable, acceptable; E--fair, less than; F--poor; G--none.

	Scale; Unit of Measurement	Total Summary	Link	Walnut Creek Station C	Link	Rudgear Road Station	Link	Stone Valley Road Station	Link	Danville Station	Link	San Ramon Station	Link	Dublin Station A	Link	Pleasanton Station F	Link	Livermore Station L	Link	Livermore Station O
1. Objective: Minimize BART Construction and Operating Costs																				
b. Total capital cost	Ratio; million $	344																		
2. Objective: Maximize BART Usage																				
a. Population potential within 1,500 ft. of stations	Ratio; persons	24,380		100		4,000		200		2,100		500		1,300		4,680		4,100		7,500
b. Population 1980 within 1 mile service area from stations	Ratio; persons	132,100		7,200[a]		21,000[a]		13,100[a]		16,000[a]		11,500[a]		20,000		8,400		23,700		11,200
c. Population potential within 1 mile service area from stations in addition to Criterion b	Ratio; persons	76,500		9,100[b]		11,400[b]		22,300[b]		20,100[b]		3,400[b]		3,500		2,800		700		3,200
d. Accessibility of stations to 1980 population within 8 minutes driving time	Ratio; index = population ÷ driving time to station	34		n.a.		n.a.		n.a.		n.a.		n.a.		n.a.		24		93		20
e. Existing and potential employment 1972	Ratio; persons	6,190		5,050		0		0		20		200		100		0		800		20
within 1,500 feet of stations (1990)	Ratio; persons	(27,570)		(20,000)		(0)		(0)		(20)		(2,000)		(150)		(1,800)		(1,600)		(2,000)
f. BART patronage projections, 1980	Ratio; total trips	22,660																		
g. Average travel time for Valley BART patrons	Ratio; minutes	40.54																		
h. Suitability to serve young, old, poor, and disabled	Ordinal			G		F		G		G		F		E		G		D		F
4. Objective: Avoid Change in Developed Residential Neighborhoods																				
a. Proximity of stations to existing development	Interval; index increases with distance	17		0		0		0		0		100		0		14		0		38
b. Propensity for change in neighborhoods near BART stations	Interval; index decreases with acreage subject to change	62		100		46		39		3		66		53		95		56		98
c. Line displacement	Ratio; residences	89	68		4		0		0		0		0		0		0		17	
	Ratio; businesses	15	5		0		0		0		0		0		0		0		10	
d. Access to station site	Ordinal			B		C		C		C		B		B		B		B		D
e. Station displacement	Ratio; residences	28		0		5		0		23		0		0		0		0		0
	Ratio; businesses	1		1		0		0		0		0		0		0		0		0
5. Objective: Maximize Environmental Compatibility																				
a. Noise levels	Ordinal; rank based on linear feet		E		A		A		A		D		F		F		B		B	
b. Visual and physical fit	Ordinal		E	B	B	E	E	E	E	D	D	D	C	D	C	E	D	D	E	E
c. Urban design potential	Ordinal			A		E		E		E		E		E		C		D		F
6. Objective: Minimize Inequities Created by a BART Extension																				
a. Displacement by stations and routes	Ratio; residences	117	68	0	4	5	0	0	0	23	0	0	0	0	0	0	0	0	17	0
	Ratio; businesses	16	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
7. Objective: Preserve Maximum Open Space																				
a. Population potential within 1,500 ft. of stations	Ratio; persons	24,380		0		4,000		200		2,100		500		1,300		4,680		4,100		7,500
b. Population potential within 1 mile service area from stations	Ratio; persons	208,600		16,300[b]		32,400[b]		35,400[b]		36,100[b]		14,900[b]		23,500		11,200		24,400		14,400
11. Objective: Maximize Economic Development at Point of Connection to Existing BART Line																				
a. Net change in jobs projected in 1990 within 1 mile of extension terminal	Ordinal	C																		
b. Net change in RTTPP I projected attractions with an extension	Ratio; trips	+74																		
c. Development potential near extension terminal	Ordinal	C																		
13. Objective: Maximize Compatibility with Existing General Plans																				
a. Degree of conflict with existing general plans	Ordinal			C		E		E		E		D		D		D		E		D
14. Objective: Maximize Compatibility with Existing BART System and with Other Potential Transit Extensions																				
a. Available capacity on existing line	Ordinal	E																		
b. Compatibility with transfers to a bus system	Ordinal	C																		
c. Compatibility with transfers to a rail system	Ordinal	B																		

[a] 1980 tributary population (approximately 2-1/2 miles).

[b] 1990 tributary population (approximately 2-1/2 miles).

ORANGE LINE EVALUATION (San Ramon Corridor 30.0 Miles)

Judgment Measures On An Ordinal Scale:

A--100% or exceptional; B--excellent; C--good, better than; D--average, workable, acceptable; E--fair, less than; F--poor; G--none.

	Scale; Unit of Measurement	Total Summary	Link	Walnut Creek Station W	Link	Livorna Road Station	Link	Danville Station	Link	San Ramon Station	Link	Dublin Station A	Link	Pleasanton Station Q	Link	Pleasanton Station J	Link	Livermore Station L	Link	Livermore Station O
1. Objective: Minimize BART Construction and Operating Costs																				
b. Total capital cost	Ratio; million $	331																		
2. Objective: Maximize BART Usage																				
a. Population potential within 1,500 ft. of stations	Ratio; persons	22,200		1,200		200		2,100		500		1,300		1,200		4,100		4,100		7,500
b. Population 1980 within 1 mile service area from stations	Ratio; persons	155,400		24,000[a]		31,000[a]		16,000[a]		11,500[a]		20,000		8,600		9,400		23,700		11,200
c. Population potential within 1 mile service area from stations in addition to Criterion b	Ratio; persons	62,000		8,700[b]		16,400[b]		20,100[b]		3,400[b]		3,500		3,700		2,300		700		3,200
d. Accessibility of stations to 1980 population within 8 minutes driving time	Ratio; index = population ÷ driving time to station	61		n.a.		n.a.		n.a.		n.a.		n.a.		69		63		93		20
e. Existing and potential employment 1972	Ratio; persons	4,260		2,750		0		20		200		100		50		20		800		20
within 1,500 feet of stations (1990)	Ratio; persons	(22,620)		(15,150)		(0)		(20)		(2,000)		(150)		(300)		(1,000)		(1,600)		(2,000)
f. BART patronage projections, 1980	Ratio; total trips	22,660																		
g. Average travel time for Valley BART patrons	Ratio; minutes	41.18																		
h. Suitability to serve young, old, poor, and disabled	Ordinal			E		G		G		F		E		E		D		D		F
4. Objective: Avoid Change in Developed Residential Neighborhoods																				
a. Proximity of stations to existing development	Interval; index increases with distance	17		0		0		0		100		0		12		0		0		38
b. Propensity for change in neighborhoods near BART stations	Interval; index decreases with acreage subject to change	64		69		39		3		66		53		98		97		56		98
c. Line displacement	Ratio; residences	101	58		26		0		0		0		0		0		0		17	
	Ratio; businesses	16	4		2		0		0		0		0		0		0		10	
d. Access to station site	Ordinal			B		D		C		B		B		C		A		B		B
e. Station displacement	Ratio; residences	55		32		0		23		0		0		0		0		0		0
	Ratio; businesses	0		0		0		0		0		0		0		0		0		0
5. Objective: Maximize Environmental Compatibility																				
a. Noise levels	Ordinal; rank based on linear feet		E		D		A		D		F		F		F		D		B	
b. Visual and physical fit	Ordinal		E	D	E	E	E	D	D	D	C	D	D	D	C	D	E	D	E	E
c. Urban design potential	Ordinal			D		E		E		E		E		E		D		D		F
6. Objective: Minimize Inequities Created by a BART Extension																				
a. Displacement by stations and routes	Ratio; residences	156	58	32	26	0	0	23	0	0	0	0	0	0	0	0	0	0	17	0
	Ratio; businesses	16	4	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
7. Objective: Preserve Maximum Open Space																				
a. Population potential within 1,500 ft. of stations	Ratio; persons	22,200		1,200		200		2,100		500		1,300		1,200		4,100		4,100		7,500
b. Population potential within 1 mile service area from stations	Ratio; persons	217,400		32,700[b]		47,400[b]		36,100[b]		14,900[b]		23,500		12,300		11,700		24,400		14,400
11. Objective: Maximize Economic Development at Point of Connection to Existing BART Line																				
a. Net change in jobs projected in 1990 within 1 mile of extension terminal	Ordinal	C																		
b. Net change in RTTPP I projected attractions with an extension	Ratio; trips	+74																		
c. Development potential near extension terminal	Ordinal	C																		
13. Objective: Maximize Compatibility with Existing General Plans																				
a. Degree of conflict with existing general plans	Ordinal			E		E		E		D		D		D		D		E		D
14. Objective: Maximize Compatibility with Existing BART System and with Other Potential Transit Extensions																				
a. Available capacity on existing line	Ordinal	E																		
b. Compatibility with transfers to a bus system	Ordinal	B																		
c. Compatibility with transfers to a rail system	Ordinal	D																		

[a] 1980 tributary population (approximately 2-1/2 miles).

[b] 1990 tributary population (approximately 2-1/2 miles).